

# SEQUENCE LISTING

<110> St. Geme, Joseph W.

<120> HAEMOPHILUS ADHERENCE AND PENETRATION PROTIENS

<130> A-59941-1/RFT/DCF/DHR

<150> US 08/296,791

<151> 1994-10-25

<150> US 09/839,996

<151> 2001-04-20

<160> 58

<170> PatentIn version 3.1

<210> 1

<211> 4319

<212> DNA

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Met Lys Lys Thr Val Phe Arg Leu Asn Phe Leu Thr Ala Cys Ile Ser
1          5          10          15

tta ggg ata gta tcg caa gcg tgg gct ggt cac act tat ttt ggg att      155
Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr Phe Gly Ile
          20          25          30

gat tac caa tat tat cgt gat ttt gcc gag aat aaa ggg aag ttc aca      203
Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe Thr
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gtt ggg gct caa aat att aag gtt tat aac aaa caa ggg caa tta gtt      251
Val Gly Ala Gln Asn Ile Lys Val Tyr Asn Lys Gln Gly Gln Leu Val
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ggc aca tca atg aca aaa gcc ccg atg att gat ttt tct gta gtg tca      299
Gly Thr Ser Met Thr Lys Ala Pro Met Ile Asp Phe Ser Val Val Ser
65          70          75          80

cgt aac ggc gtg gca gcc ttg gtt gaa aat caa tat att gtg agc gtg      347
Arg Asn Gly Val Ala Ala Leu Val Glu Asn Gln Tyr Ile Val Ser Val
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gca cat aac gta gga tat aca gat gtt gat ttt ggt gca gag gga aac      395
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|   |      |
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| 100 105 110   |      |
| aac ccc gat caa cat cgt ttt act tat aag att gta aaa cga aat aac | 443  |
| Asn Pro Asp Gln His Arg Phe Thr Tyr Lys Ile Val Lys Arg Asn Asn |      |
| 115 120 125   |      |
| tac aaa aaa gat aat tta cat cct tat gag gac gat tac cat aat cca | 491  |
| Tyr Lys Lys Asp Asn Leu His Pro Tyr Glu Asp Tyr His Asn Pro     |      |
| 130 135 140   |      |
| cga tta cat aaa ttc gtt aca gaa gcg gct cca att gat atg act tcg | 539  |
| Arg Leu His Lys Phe Val Thr Glu Ala Ala Pro Ile Asp Met Thr Ser |      |
| 145 150 155 160   |      |
| aat atg aat ggc agt act tat tca gat aga aca aaa tat cca gaa cgt | 587  |
| Asn Met Asn Gly Ser Thr Tyr Ser Asp Arg Thr Lys Tyr Pro Glu Arg |      |
| 165 170 175   |      |
| gtt cgt atc ggc tct gga cgg cag ttt tgg cga aat gat caa gac aaa | 635  |
| Val Arg Ile Gly Ser Gly Arg Gln Phe Trp Arg Asn Asp Gln Asp Lys |      |
| 180 185 190   |      |
| ggc gac caa gtt gcc ggt gca tat cat tat ctg aca gct ggc aat aca | 683  |
| Gly Asp Gln Val Ala Gly Ala Tyr His Tyr Leu Thr Ala Gly Asn Thr |      |
| 195 200 205   |      |
| cac aat cag cgt gga gca ggt aat gga tat tcg tat ttg gga ggc gat | 731  |
| His Asn Gln Arg Gly Ala Gly Asn Gly Tyr Ser Tyr Leu Gly Gly Asp |      |
| 210 215 220   |      |
| gtt cgt aaa gcg gga gaa tat ggt cca tta ccg att gca ggc tca aag | 779  |
| Val Arg Lys Ala Gly Glu Tyr Gly Pro Leu Pro Ile Ala Gly Ser Lys |      |
| 225 230 235 240   |      |
| ggg gac agt ggt tct ccg atg ttt att tat gat gct gaa aaa caa aaa | 827  |
| Gly Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp Ala Glu Lys Gln Lys |      |
| 245 250 255   |      |
| tgg tta att aat ggg ata tta cgg gaa ggc aac cct ttt gaa ggc aaa | 875  |
| Trp Leu Ile Asn Gly Ile Leu Arg Glu Gly Asn Pro Phe Glu Gly Lys |      |
| 260 265 270   |      |
| gaa aat ggg ttt caa ttg gtt cgc aaa tct tat ttt gat gaa att ttc | 923  |
| Glu Asn Gly Phe Gln Leu Val Arg Lys Ser Tyr Phe Asp Glu Ile Phe |      |
| 275 280 285   |      |
| gaa aga gat tta cat aca tca ctt tac acc cga gct ggt aat gga gtg | 971  |
| Glu Arg Asp Leu His Thr Ser Leu Tyr Thr Arg Ala Gly Asn Gly Val |      |
| 290 295 300   |      |
| tac aca att agt gga aat gat aat ggt cag ggg tct ata act cag aaa | 1019 |
| Tyr Thr Ile Ser Gly Asn Asp Asn Gly Gln Gly Ser Ile Thr Gln Lys |      |
| 305 310 315 320   |      |
| tca gga ata cca tca gaa att aaa att acg tta gca aat atg agt tta | 1067 |
| Ser Gly Ile Pro Ser Glu Ile Lys Ile Thr Leu Ala Asn Met Ser Leu |      |

| 325 |     |     |     |     |     |     |     |     |     | 330 |     |     |     |     |     |  |      |  |  | 335 |  |  |  |  |  |  |  |  |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|------|--|--|-----|--|--|--|--|--|--|--|--|--|--|
| cct | ttg | aaa | gag | aag | gat | aaa | gtt | cat | aat | cct | aga | tat | gac | gga | cct |  | 1115 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| Pro | Leu | Lys | Glu | Lys | Asp | Lys | Val | His | Asn | Pro | Arg | Tyr | Asp | Gly | Pro |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
|     |     |     | 340 |     |     |     |     |     | 345 |     |     |     |     | 350 |     |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
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| Asn | Ile | Tyr | Ser | Pro | Arg | Leu | Asn | Asn | Gly | Glu | Thr | Leu | Tyr | Phe | Met |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
|     |     | 355 |     |     |     |     | 360 |     |     |     |     |     | 365 |     |     |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| gat | caa | aaa | caa | gga | tca | tta | atc | ttc | gca | tct | gac | att | aac | caa | ggg |  | 1211 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| Asp | Gln | Lys | Gln | Gly | Ser | Leu | Ile | Phe | Ala | Ser | Asp | Ile | Asn | Gln | Gly |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
|     | 370 |     |     |     |     | 375 |     |     |     |     | 380 |     |     |     |     |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| gcg | ggt | ggt | ctt | tat | ttt | gag | ggt | aat | ttt | aca | gta | tct | cca | aat | tct |  | 1259 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| Ala | Gly | Gly | Leu | Tyr | Phe | Glu | Gly | Asn | Phe | Thr | Val | Ser | Pro | Asn | Ser |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| 385 |     |     |     |     | 390 |     |     |     | 395 |     |     |     |     |     | 400 |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| aac | caa | act | tgg | caa | gga | gct | ggc | ata | cat | gta | agt | gaa | aat | agc | acc |  | 1307 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| Asn | Gln | Thr | Trp | Gln | Gly | Ala | Gly | Ile | His | Val | Ser | Glu | Asn | Ser | Thr |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
|     |     |     | 405 |     |     |     |     | 410 |     |     |     |     |     | 415 |     |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
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| Val | Thr | Trp | Lys | Val | Asn | Gly | Val | Glu | His | Asp | Arg | Leu | Ser | Lys | Ile |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
|     |     |     | 420 |     |     |     | 425 |     |     |     |     |     | 430 |     |     |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| ggt | aaa | gga | aca | ttg | cac | gtt | caa | gcc | aaa | ggg | gaa | aat | aaa | ggt | tcg |  | 1403 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| Gly | Lys | Gly | Thr | Leu | His | Val | Gln | Ala | Lys | Gly | Glu | Asn | Lys | Gly | Ser |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
|     |     | 435 |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| atc | agc | gta | ggc | gat | ggt | aaa | gtc | att | ttg | gag | cag | cag | gca | gac | gat |  | 1451 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| Ile | Ser | Val | Gly | Asp | Gly | Lys | Val | Ile | Leu | Glu | Gln | Gln | Ala | Asp | Asp |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
|     |     | 450 |     |     |     | 455 |     |     |     |     | 460 |     |     |     |     |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| caa | ggc | aac | aaa | caa | gcc | ttt | agt | gaa | att | ggc | ttg | gtt | agc | ggc | aga |  | 1499 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| Gln | Gly | Asn | Lys | Gln | Ala | Phe | Ser | Glu | Ile | Gly | Leu | Val | Ser | Gly | Arg |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| 465 |     |     |     |     | 470 |     |     |     |     | 475 |     |     |     |     | 480 |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| ggg | act | gtt | caa | tta | aac | gat | gat | aaa | caa | ttt | gat | acc | gat | aaa | ttt |  | 1547 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| Gly | Thr | Val | Gln | Leu | Asn | Asp | Asp | Lys | Gln | Phe | Asp | Thr | Asp | Lys | Phe |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
|     |     |     |     | 485 |     |     |     | 490 |     |     |     |     |     | 495 |     |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| tat | ttc | ggc | ttt | cgt | ggt | ggt | cgc | tta | gat | ctt | aac | ggg | cat | tca | tta |  | 1595 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| Tyr | Phe | Gly | Phe | Arg | Gly | Gly | Arg | Leu | Asp | Leu | Asn | Gly | His | Ser | Leu |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
|     |     |     | 500 |     |     |     |     | 505 |     |     |     |     | 510 |     |     |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| acc | ttt | aaa | cgt | atc | caa | aat | acg | gac | gag | ggg | gca | atg | att | gtg | aac |  | 1643 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| Thr | Phe | Lys | Arg | Ile | Gln | Asn | Thr | Asp | Glu | Gly | Ala | Met | Ile | Val | Asn |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
|     |     | 515 |     |     |     |     | 520 |     |     |     |     | 525 |     |     |     |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| cat | aat | aca | act | caa | gcc | gct | aat | gtc | act | att | act | ggg | aac | gaa | agc |  | 1691 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| His | Asn | Thr | Thr | Gln | Ala | Ala | Asn | Val | Thr | Ile | Thr | Gly | Asn | Glu | Ser |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
|     |     | 530 |     |     |     | 535 |     |     |     |     | 540 |     |     |     |     |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| att | gtt | cta | cct | aat | gga | aat | aat | att | aat | aaa | ctt | gat | tac | aga | aaa |  | 1739 |  |  |     |  |  |  |  |  |  |  |  |  |  |
| Ile | Val | Leu | Pro | Asn | Gly | Asn | Asn | Ile | Asn | Lys | Leu | Asp | Tyr | Arg | Lys |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |
| 545 |     |     |     |     | 550 |     |     |     |     | 555 |     |     |     |     | 560 |  |      |  |  |     |  |  |  |  |  |  |  |  |  |  |

|   |      |
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| gaa att gcc tac aac ggt tgg ttt ggc gaa aca gat aaa aat aaa cac<br>Glu Ile Ala Tyr Asn Gly Trp Phe Gly Glu Thr Asp Lys Asn Lys His<br>565 570 575     | 1787 |
| aat ggg cga tta aac ctt att tat aaa cca acc aca gaa gat cgt act<br>Asn Gly Arg Leu Asn Leu Ile Tyr Lys Pro Thr Thr Glu Asp Arg Thr<br>580 585 590     | 1835 |
| ttg cta ctt tca ggt ggt aca aat tta aaa ggc gat att acc caa aca<br>Leu Leu Leu Ser Gly Gly Thr Asn Leu Lys Gly Asp Ile Thr Gln Thr<br>595 600 605     | 1883 |
| aaa ggt aaa cta ttt ttc agc ggt aga ccg aca ccg cac gcc tac aat<br>Lys Gly Lys Leu Phe Phe Ser Gly Arg Pro Thr Pro His Ala Tyr Asn<br>610 615 620     | 1931 |
| cat tta aat aaa cgt tgg tca gaa atg gaa ggt ata cca caa ggc gaa<br>His Leu Asn Lys Arg Trp Ser Glu Met Glu Gly Ile Pro Gln Gly Glu<br>625 630 635 640 | 1979 |
| att gtg tgg gat cac gat tgg atc aac cgt aca ttt aaa gct gaa aac<br>Ile Val Trp Asp His Asp Trp Ile Asn Arg Thr Phe Lys Ala Glu Asn<br>645 650 655     | 2027 |
| ttc caa att aaa ggc gga agt gcg gtg gtt tct cgc aat gtt tct tca<br>Phe Gln Ile Lys Gly Gly Ser Ala Val Val Ser Arg Asn Val Ser Ser<br>660 665 670     | 2075 |
| att gag gga aat tgg aca gtc agc aat aat gca aat gcc aca ttt ggt<br>Ile Glu Gly Asn Trp Thr Val Ser Asn Asn Ala Asn Ala Thr Phe Gly<br>675 680 685     | 2123 |
| gtt gtg cca aat caa caa aat acc att tgc acg cgt tca gat tgg aca<br>Val Val Pro Asn Gln Gln Asn Thr Ile Cys Thr Arg Ser Asp Trp Thr<br>690 695 700     | 2171 |
| gga tta acg act tgt caa aaa gtg gat tta acc gat aca aaa gtt att<br>Gly Leu Thr Thr Cys Gln Lys Val Asp Leu Thr Asp Thr Lys Val Ile<br>705 710 715 720 | 2219 |
| aat tct ata cca aaa aca caa atc aat ggc tct att aat tta act gat<br>Asn Ser Ile Pro Lys Thr Gln Ile Asn Gly Ser Ile Asn Leu Thr Asp<br>725 730 735     | 2267 |
| aat gca acg gcg aat gtt aaa ggt tta gca aaa ctt aat ggc aat gtc<br>Asn Ala Thr Ala Asn Val Lys Gly Leu Ala Lys Leu Asn Gly Asn Val<br>740 745 750     | 2315 |
| act tta aca aat cac agc caa ttt aca tta agc aac aat gcc acc caa<br>Thr Leu Thr Asn His Ser Gln Phe Thr Leu Ser Asn Asn Ala Thr Gln<br>755 760 765     | 2363 |
| ata ggc aat att cga ctt tcc gac aat tca act gca acg gtg gat aat<br>Ile Gly Asn Ile Arg Leu Ser Asp Asn Ser Thr Ala Thr Val Asp Asn<br>770 775 780     | 2411 |

|   |      |
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| gca aac ttg aac ggt aat gtg cat tta acg gat tca gct caa ttt tct | 2459 |
| Ala Asn Leu Asn Gly Asn Val His Leu Thr Asp Ser Ala Gln Phe Ser |      |
| 785 790 795 800   |      |
| tta aaa aac agc cat ttt tcg cac caa att cag gga gac aaa ggc aca | 2507 |
| Leu Lys Asn Ser His Phe Ser His Gln Ile Gln Gly Asp Lys Gly Thr |      |
| 805 810 815   |      |
| aca gtg acg ttg gaa aat gcg act tgg aca atg cct agc gat act aca | 2555 |
| Thr Val Thr Leu Glu Asn Ala Thr Trp Thr Met Pro Ser Asp Thr Thr |      |
| 820 825 830   |      |
| ttg cag aat tta acg cta aat aac agt acg atc acg tta aat tca gct | 2603 |
| Leu Gln Asn Leu Thr Leu Asn Asn Ser Thr Ile Thr Leu Asn Ser Ala |      |
| 835 840 845   |      |
| tat tca gct agc tca aac aat acg cca cgt cgc cgt tca tta gag acg | 2651 |
| Tyr Ser Ala Ser Ser Asn Asn Thr Pro Arg Arg Arg Ser Leu Glu Thr |      |
| 850 855 860   |      |
| gaa aca acg cca aca tcg gca gaa cat cgt ttc aac aca ttg aca gta | 2699 |
| Glu Thr Thr Pro Thr Ser Ala Glu His Arg Phe Asn Thr Leu Thr Val |      |
| 865 870 875 880   |      |
| aat ggt aaa ttg agt ggg caa ggc aca ttc caa ttt act tca tct tta | 2747 |
| Asn Gly Lys Leu Ser Gly Gln Gly Thr Phe Gln Phe Thr Ser Ser Leu |      |
| 885 890 895   |      |
| ttt ggc tat aaa agc gat aaa tta aaa tta tcc aat gac gct gag ggc | 2795 |
| Phe Gly Tyr Lys Ser Asp Lys Leu Lys Leu Ser Asn Asp Ala Glu Gly |      |
| 900 905 910   |      |
| gat tac ata tta tct gtt cgc aac aca ggc aaa gaa ccc gaa acc ctt | 2843 |
| Asp Tyr Ile Leu Ser Val Arg Asn Thr Gly Lys Glu Pro Glu Thr Leu |      |
| 915 920 925   |      |
| gag caa tta act ttg gtt gaa agc aaa gat aat caa ccg tta tca gat | 2891 |
| Glu Gln Leu Thr Leu Val Glu Ser Lys Asp Asn Gln Pro Leu Ser Asp |      |
| 930 935 940   |      |
| aag ctc aaa ttt act tta gaa aat gac cac gtt gat gca ggt gca tta | 2939 |
| Lys Leu Lys Phe Thr Leu Glu Asn Asp His Val Asp Ala Gly Ala Leu |      |
| 945 950 955 960   |      |
| cgt tat aaa tta gtg aag aat gat ggc gaa ttc cgc ttg cat aac cca | 2987 |
| Arg Tyr Lys Leu Val Lys Asn Asp Gly Glu Phe Arg Leu His Asn Pro |      |
| 965 970 975   |      |
| ata aaa gag cag gaa ttg cac aat gat tta gta aga gca gag caa gca | 3035 |
| Ile Lys Glu Gln Glu Leu His Asn Asp Leu Val Arg Ala Glu Gln Ala |      |
| 980 985 990   |      |
| gaa cga aca tta gaa gcc aaa caa gtt gaa ccg act gct aaa aca caa | 3083 |
| Glu Arg Thr Leu Glu Ala Lys Gln Val Glu Pro Thr Ala Lys Thr Gln |      |
| 995 1000 1005   |      |
| aca ggt gag cca aaa gtg cgg tca aga aga gca gcg aga gca gcg     | 3128 |

|         |                 |      |                 |      |             |      |
|---------|-----------------|------|-----------------|------|-------------|------|
| Thr Gly | Glu Pro Lys Val | Arg  | Ser Arg Arg Ala | Ala  | Arg Ala Ala |      |
| 1010    |                 | 1015 |                 | 1020 |             |      |
| ttt cct | gat acc ctg cct | gat  | caa agc ctg tta | aac  | gca tta gaa | 3173 |
| Phe Pro | Asp Thr Leu Pro | Asp  | Gln Ser Leu Leu | Asn  | Ala Leu Glu |      |
| 1025    |                 | 1030 |                 | 1035 |             |      |
| gcc aaa | caa gct gaa ctg | act  | gct gaa aca caa | aaa  | agt aag gca | 3218 |
| Ala Lys | Gln Ala Glu Leu | Thr  | Ala Glu Thr Gln | Lys  | Ser Lys Ala |      |
| 1040    |                 | 1045 |                 | 1050 |             |      |
| aaa aca | aaa aaa gtg cgg | tca  | aaa aga gca gtg | ttt  | tct gat ccc | 3263 |
| Lys Thr | Lys Lys Val Arg | Ser  | Lys Arg Ala Val | Phe  | Ser Asp Pro |      |
| 1055    |                 | 1060 |                 | 1065 |             |      |
| ctg ctt | gat caa agc ctg | ttc  | gca tta gaa gcc | gca  | ctt gag gtt | 3308 |
| Leu Leu | Asp Gln Ser Leu | Phe  | Ala Leu Glu Ala | Ala  | Leu Glu Val |      |
| 1070    |                 | 1075 |                 | 1080 |             |      |
| att gat | gcc cca cag caa | tcg  | gaa aaa gat cgt | cta  | gct caa gaa | 3353 |
| Ile Asp | Ala Pro Gln Gln | Ser  | Glu Lys Asp Arg | Leu  | Ala Gln Glu |      |
| 1085    |                 | 1090 |                 | 1095 |             |      |
| gaa gcg | gaa aaa caa cgc | aaa  | caa aaa gac ttg | atc  | agc cgt tat | 3398 |
| Glu Ala | Glu Lys Gln Arg | Lys  | Gln Lys Asp Leu | Ile  | Ser Arg Tyr |      |
| 1100    |                 | 1105 |                 | 1110 |             |      |
| tca aat | agt gcg tta tca | gaa  | tta tct gca aca | gta  | aat agt atg | 3443 |
| Ser Asn | Ser Ala Leu Ser | Glu  | Leu Ser Ala Thr | Val  | Asn Ser Met |      |
| 1115    |                 | 1120 |                 | 1125 |             |      |
| ctt tct | gtt caa gat gaa | tta  | gat cgt ctt ttt | gta  | gat caa gca | 3488 |
| Leu Ser | Val Gln Asp Glu | Leu  | Asp Arg Leu Phe | Val  | Asp Gln Ala |      |
| 1130    |                 | 1135 |                 | 1140 |             |      |
| caa tct | gcc gtg tgg aca | aat  | atc gca cag gat | aaa  | aga cgc tat | 3533 |
| Gln Ser | Ala Val Trp Thr | Asn  | Ile Ala Gln Asp | Lys  | Arg Arg Tyr |      |
| 1145    |                 | 1150 |                 | 1155 |             |      |
| gat tct | gat gcg ttc cgt | gct  | tat cag cag cag | aaa  | acg aac tta | 3578 |
| Asp Ser | Asp Ala Phe Arg | Ala  | Tyr Gln Gln Gln | Lys  | Thr Asn Leu |      |
| 1160    |                 | 1165 |                 | 1170 |             |      |
| cgt caa | att ggg gtg caa | aaa  | gcc tta gct aat | gga  | cga att ggg | 3623 |
| Arg Gln | Ile Gly Val Gln | Lys  | Ala Leu Ala Asn | Gly  | Arg Ile Gly |      |
| 1175    |                 | 1180 |                 | 1185 |             |      |
| gca gtt | ttc tcg cat agc | cgt  | tca gat aat acc | ttt  | gat gaa cag | 3668 |
| Ala Val | Phe Ser His Ser | Arg  | Ser Asp Asn Thr | Phe  | Asp Glu Gln |      |
| 1190    |                 | 1195 |                 | 1200 |             |      |
| gtt aaa | aat cac gcg aca | tta  | acg atg atg tcg | ggt  | ttt gcc caa | 3713 |
| Val Lys | Asn His Ala Thr | Leu  | Thr Met Met Ser | Gly  | Phe Ala Gln |      |
| 1205    |                 | 1210 |                 | 1215 |             |      |
| tat caa | tgg ggc gat tta | caa  | ttt ggt gta aac | gtg  | gga acg gga | 3758 |
| Tyr Gln | Trp Gly Asp Leu | Gln  | Phe Gly Val Asn | Val  | Gly Thr Gly |      |

| 1220                              | 1225                 | 1230        |      |
|-----------------------------------|----------------------|-------------|------|
| atc agt gcg agt aaa atg gct       | gaa gaa caa agc cga  | aaa att cat | 3803 |
| Ile Ser Ala Ser Lys Met Ala       | Glu Glu Gln Ser Arg  | Lys Ile His |      |
| 1235                              | 1240                 | 1245        |      |
| cga aaa gcg ata aat tat ggc       | gtg aat gca agt tat  | cag ttc cgt | 3848 |
| Arg Lys Ala Ile Asn Tyr Gly       | Val Asn Ala Ser Tyr  | Gln Phe Arg |      |
| 1250                              | 1255                 | 1260        |      |
| tta ggg caa ttg ggc att cag       | cct tat ttt gga gtt  | aat cgc tat | 3893 |
| Leu Gly Gln Leu Gly Ile Gln       | Pro Tyr Phe Gly Val  | Asn Arg Tyr |      |
| 1265                              | 1270                 | 1275        |      |
| ttt att gaa cgt gaa aat tat       | caa tct gag gaa gtg  | aga gtg aaa | 3938 |
| Phe Ile Glu Arg Glu Asn Tyr       | Gln Ser Glu Glu Val  | Arg Val Lys |      |
| 1280                              | 1285                 | 1290        |      |
| acg cct agc ctt gca ttt aat       | cgc tat aat gct ggc  | att cga gtt | 3983 |
| Thr Pro Ser Leu Ala Phe Asn       | Arg Tyr Asn Ala Gly  | Ile Arg Val |      |
| 1295                              | 1300                 | 1305        |      |
| gat tat aca ttt act ccg aca       | gat aat atc agc gtt  | aag cct tat | 4028 |
| Asp Tyr Thr Phe Thr Pro Thr       | Asp Asn Ile Ser Val  | Lys Pro Tyr |      |
| 1310                              | 1315                 | 1320        |      |
| ttc ttc gtc aat tat gtt gat       | gtt tca aac gct aac  | gta caa acc | 4073 |
| Phe Phe Val Asn Tyr Val Asp       | Val Ser Asn Ala Asn  | Val Gln Thr |      |
| 1325                              | 1330                 | 1335        |      |
| acg gta aat ctc acg gtg ttg       | caa caa cca ttt gga  | cgt tat tgg | 4118 |
| Thr Val Asn Leu Thr Val Leu       | Gln Gln Pro Phe Gly  | Arg Tyr Trp |      |
| 1340                              | 1345                 | 1350        |      |
| caa aaa gaa gtg gga tta aag       | gca gaa att tta cat  | ttc caa att | 4163 |
| Gln Lys Glu Val Gly Leu Lys       | Ala Glu Ile Leu His  | Phe Gln Ile |      |
| 1355                              | 1360                 | 1365        |      |
| tcc gct ttt atc tca aaa tct       | caa ggt tca caa ctc  | ggc aaa cag | 4208 |
| Ser Ala Phe Ile Ser Lys Ser       | Gln Gly Ser Gln Leu  | Gly Lys Gln |      |
| 1370                              | 1375                 | 1380        |      |
| caa aat gtg ggc gtg aaa ttg       | ggc tat cgt tgg      | taaaaatcaa  | 4251 |
| Gln Asn Val Gly Val Lys Leu       | Gly Tyr Arg Trp      |             |      |
| 1385                              | 1390                 |             |      |
| cataatttta tcggtttattg ataaacaagg | tgggtcagat cagatccac | cttttttatt  | 4311 |
| ccaataat                          |                      |             | 4319 |

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 <212> PRT  
 <213> Haemophilus influenzae

<400> 2

Met Lys Lys Thr Val Phe Arg Leu Asn Phe Leu Thr Ala Cys Ile Ser  
 1 5 10 15

Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr Phe Gly Ile  
 20 25 30

Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe Thr  
 35 40 45

Val Gly Ala Gln Asn Ile Lys Val Tyr Asn Lys Gln Gly Gln Leu Val  
 50 55 60

Gly Thr Ser Met Thr Lys Ala Pro Met Ile Asp Phe Ser Val Val Ser  
 65 70 75 80

Arg Asn Gly Val Ala Ala Leu Val Glu Asn Gln Tyr Ile Val Ser Val  
 85 90 95

Ala His Asn Val Gly Tyr Thr Asp Val Asp Phe Gly Ala Glu Gly Asn  
 100 105 110

Asn Pro Asp Gln His Arg Phe Thr Tyr Lys Ile Val Lys Arg Asn Asn  
 115 120 125

Tyr Lys Lys Asp Asn Leu His Pro Tyr Glu Asp Asp Tyr His Asn Pro  
 130 135 140

Arg Leu His Lys Phe Val Thr Glu Ala Ala Pro Ile Asp Met Thr Ser  
 145 150 155 160

Asn Met Asn Gly Ser Thr Tyr Ser Asp Arg Thr Lys Tyr Pro Glu Arg  
 165 170 175

Val Arg Ile Gly Ser Gly Arg Gln Phe Trp Arg Asn Asp Gln Asp Lys  
 180 185 190

Gly Asp Gln Val Ala Gly Ala Tyr His Tyr Leu Thr Ala Gly Asn Thr  
 195 200 205

His Asn Gln Arg Gly Ala Gly Asn Gly Tyr Ser Tyr Leu Gly Gly Asp  
 210 215 220



Val Arg Lys Ala Gly Glu Tyr Gly Pro Leu Pro Ile Ala Gly Ser Lys  
 225 230 235 240

Gly Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp Ala Glu Lys Gln Lys  
 245 250 255

Trp Leu Ile Asn Gly Ile Leu Arg Glu Gly Asn Pro Phe Glu Gly Lys  
 260 265 270

Glu Asn Gly Phe Gln Leu Val Arg Lys Ser Tyr Phe Asp Glu Ile Phe  
 275 280 285

Glu Arg Asp Leu His Thr Ser Leu Tyr Thr Arg Ala Gly Asn Gly Val  
 290 295 300

Tyr Thr Ile Ser Gly Asn Asp Asn Gly Gln Gly Ser Ile Thr Gln Lys  
 305 310 315 320

Ser Gly Ile Pro Ser Glu Ile Lys Ile Thr Leu Ala Asn Met Ser Leu  
 325 330 335

Pro Leu Lys Glu Lys Asp Lys Val His Asn Pro Arg Tyr Asp Gly Pro  
 340 345 350

Asn Ile Tyr Ser Pro Arg Leu Asn Asn Gly Glu Thr Leu Tyr Phe Met  
 355 360 365

Asp Gln Lys Gln Gly Ser Leu Ile Phe Ala Ser Asp Ile Asn Gln Gly  
 370 375 380

Ala Gly Gly Leu Tyr Phe Glu Gly Asn Phe Thr Val Ser Pro Asn Ser  
 385 390 395 400

Asn Gln Thr Trp Gln Gly Ala Gly Ile His Val Ser Glu Asn Ser Thr  
 405 410 415

Val Thr Trp Lys Val Asn Gly Val Glu His Asp Arg Leu Ser Lys Ile  
 420 425 430

Gly Lys Gly Thr Leu His Val Gln Ala Lys Gly Glu Asn Lys Gly Ser  
 435 440 445

Ile Ser Val Gly Asp Gly Lys Val Ile Leu Glu Gln Gln Ala Asp Asp

|   |     |     |     |         |
|---|-----|-----|-----|---------|
| 450   |     | 455 |     | 460     |
| Gln Gly Asn Lys Gln Ala Phe Ser Glu Ile Gly Leu Val Ser Gly Arg |     |     |     |         |
| 465   |     | 470 |     | 475 480 |
| Gly Thr Val Gln Leu Asn Asp Asp Lys Gln Phe Asp Thr Asp Lys Phe |     |     |     |         |
|   | 485 |     | 490 | 495     |
| Tyr Phe Gly Phe Arg Gly Gly Arg Leu Asp Leu Asn Gly His Ser Leu |     |     |     |         |
|   | 500 |     | 505 | 510     |
| Thr Phe Lys Arg Ile Gln Asn Thr Asp Glu Gly Ala Met Ile Val Asn |     |     |     |         |
|   | 515 |     | 520 | 525     |
| His Asn Thr Thr Gln Ala Ala Asn Val Thr Ile Thr Gly Asn Glu Ser |     |     |     |         |
|   | 530 |     | 535 | 540     |
| Ile Val Leu Pro Asn Gly Asn Asn Ile Asn Lys Leu Asp Tyr Arg Lys |     |     |     |         |
| 545   |     | 550 |     | 555 560 |
| Glu Ile Ala Tyr Asn Gly Trp Phe Gly Glu Thr Asp Lys Asn Lys His |     |     |     |         |
|   | 565 |     | 570 | 575     |
| Asn Gly Arg Leu Asn Leu Ile Tyr Lys Pro Thr Thr Glu Asp Arg Thr |     |     |     |         |
|   | 580 |     | 585 | 590     |
| Leu Leu Leu Ser Gly Gly Thr Asn Leu Lys Gly Asp Ile Thr Gln Thr |     |     |     |         |
|   | 595 |     | 600 | 605     |
| Lys Gly Lys Leu Phe Phe Ser Gly Arg Pro Thr Pro His Ala Tyr Asn |     |     |     |         |
|   | 610 |     | 615 | 620     |
| His Leu Asn Lys Arg Trp Ser Glu Met Glu Gly Ile Pro Gln Gly Glu |     |     |     |         |
| 625   |     | 630 |     | 635 640 |
| Ile Val Trp Asp His Asp Trp Ile Asn Arg Thr Phe Lys Ala Glu Asn |     |     |     |         |
|   | 645 |     | 650 | 655     |
| Phe Gln Ile Lys Gly Gly Ser Ala Val Val Ser Arg Asn Val Ser Ser |     |     |     |         |
|   | 660 |     | 665 | 670     |
| Ile Glu Gly Asn Trp Thr Val Ser Asn Asn Ala Asn Ala Thr Phe Gly |     |     |     |         |
|   | 675 |     | 680 | 685     |

Val Val Pro Asn Gln Gln Asn Thr Ile Cys Thr Arg Ser Asp Trp Thr  
 690 695 700

Gly Leu Thr Thr Cys Gln Lys Val Asp Leu Thr Asp Thr Lys Val Ile  
 705 710 715 720

Asn Ser Ile Pro Lys Thr Gln Ile Asn Gly Ser Ile Asn Leu Thr Asp  
 725 730 735

Asn Ala Thr Ala Asn Val Lys Gly Leu Ala Lys Leu Asn Gly Asn Val  
 740 745 750

Thr Leu Thr Asn His Ser Gln Phe Thr Leu Ser Asn Asn Ala Thr Gln  
 755 760 765

Ile Gly Asn Ile Arg Leu Ser Asp Asn Ser Thr Ala Thr Val Asp Asn  
 770 775 780

Ala Asn Leu Asn Gly Asn Val His Leu Thr Asp Ser Ala Gln Phe Ser  
 785 790 795 800

Leu Lys Asn Ser His Phe Ser His Gln Ile Gln Gly Asp Lys Gly Thr  
 805 810 815

Thr Val Thr Leu Glu Asn Ala Thr Trp Thr Met Pro Ser Asp Thr Thr  
 820 825 830

Leu Gln Asn Leu Thr Leu Asn Asn Ser Thr Ile Thr Leu Asn Ser Ala  
 835 840 845

Tyr Ser Ala Ser Ser Asn Asn Thr Pro Arg Arg Arg Ser Leu Glu Thr  
 850 855 860

Glu Thr Thr Pro Thr Ser Ala Glu His Arg Phe Asn Thr Leu Thr Val  
 865 870 875 880

Asn Gly Lys Leu Ser Gly Gln Gly Thr Phe Gln Phe Thr Ser Ser Leu  
 885 890 895

Phe Gly Tyr Lys Ser Asp Lys Leu Lys Leu Ser Asn Asp Ala Glu Gly  
 900 905 910

Asp Tyr Ile Leu Ser Val Arg Asn Thr Gly Lys Glu Pro Glu Thr Leu  
915 920 925

Glu Gln Leu Thr Leu Val Glu Ser Lys Asp Asn Gln Pro Leu Ser Asp  
930 935 940

Lys Leu Lys Phe Thr Leu Glu Asn Asp His Val Asp Ala Gly Ala Leu  
945 950 955 960

Arg Tyr Lys Leu Val Lys Asn Asp Gly Glu Phe Arg Leu His Asn Pro  
965 970 975

Ile Lys Glu Gln Glu Leu His Asn Asp Leu Val Arg Ala Glu Gln Ala  
980 985 990

Glu Arg Thr Leu Glu Ala Lys Gln Val Glu Pro Thr Ala Lys Thr Gln  
995 1000 1005

Thr Gly Glu Pro Lys Val Arg Ser Arg Arg Ala Ala Arg Ala Ala  
1010 1015 1020

Phe Pro Asp Thr Leu Pro Asp Gln Ser Leu Leu Asn Ala Leu Glu  
1025 1030 1035

Ala Lys Gln Ala Glu Leu Thr Ala Glu Thr Gln Lys Ser Lys Ala  
1040 1045 1050

Lys Thr Lys Lys Val Arg Ser Lys Arg Ala Val Phe Ser Asp Pro  
1055 1060 1065

Leu Leu Asp Gln Ser Leu Phe Ala Leu Glu Ala Ala Leu Glu Val  
1070 1075 1080

Ile Asp Ala Pro Gln Gln Ser Glu Lys Asp Arg Leu Ala Gln Glu  
1085 1090 1095

Glu Ala Glu Lys Gln Arg Lys Gln Lys Asp Leu Ile Ser Arg Tyr  
1100 1105 1110

Ser Asn Ser Ala Leu Ser Glu Leu Ser Ala Thr Val Asn Ser Met  
1115 1120 1125

|                             |                     |             |
|-----------------------------|---------------------|-------------|
| Leu Ser Val Gln Asp Glu Leu | Asp Arg Leu Phe Val | Asp Gln Ala |
| 1130                        | 1135                | 1140        |
| Gln Ser Ala Val Trp Thr Asn | Ile Ala Gln Asp Lys | Arg Arg Tyr |
| 1145                        | 1150                | 1155        |
| Asp Ser Asp Ala Phe Arg Ala | Tyr Gln Gln Gln Lys | Thr Asn Leu |
| 1160                        | 1165                | 1170        |
| Arg Gln Ile Gly Val Gln Lys | Ala Leu Ala Asn Gly | Arg Ile Gly |
| 1175                        | 1180                | 1185        |
| Ala Val Phe Ser His Ser Arg | Ser Asp Asn Thr Phe | Asp Glu Gln |
| 1190                        | 1195                | 1200        |
| Val Lys Asn His Ala Thr Leu | Thr Met Met Ser Gly | Phe Ala Gln |
| 1205                        | 1210                | 1215        |
| Tyr Gln Trp Gly Asp Leu Gln | Phe Gly Val Asn Val | Gly Thr Gly |
| 1220                        | 1225                | 1230        |
| Ile Ser Ala Ser Lys Met Ala | Glu Glu Gln Ser Arg | Lys Ile His |
| 1235                        | 1240                | 1245        |
| Arg Lys Ala Ile Asn Tyr Gly | Val Asn Ala Ser Tyr | Gln Phe Arg |
| 1250                        | 1255                | 1260        |
| Leu Gly Gln Leu Gly Ile Gln | Pro Tyr Phe Gly Val | Asn Arg Tyr |
| 1265                        | 1270                | 1275        |
| Phe Ile Glu Arg Glu Asn Tyr | Gln Ser Glu Glu Val | Arg Val Lys |
| 1280                        | 1285                | 1290        |
| Thr Pro Ser Leu Ala Phe Asn | Arg Tyr Asn Ala Gly | Ile Arg Val |
| 1295                        | 1300                | 1305        |
| Asp Tyr Thr Phe Thr Pro Thr | Asp Asn Ile Ser Val | Lys Pro Tyr |
| 1310                        | 1315                | 1320        |
| Phe Phe Val Asn Tyr Val Asp | Val Ser Asn Ala Asn | Val Gln Thr |
| 1325                        | 1330                | 1335        |
| Thr Val Asn Leu Thr Val Leu | Gln Gln Pro Phe Gly | Arg Tyr Trp |

1340                      1345                      1350  
 Gln Lys Glu Val Gly Leu Lys Ala Glu Ile Leu His Phe Gln Ile  
 1355                      1360                      1365  
 Ser Ala Phe Ile Ser Lys Ser Gln Gly Ser Gln Leu Gly Lys Gln  
 1370                      1375                      1380  
 Gln Asn Val Gly Val Lys Leu Gly Tyr Arg Trp  
 1385                      1390  
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 1                      5                      10                      15  
 Tyr Ala Leu Thr Pro Tyr Thr Glu Ala Ala Leu Val Arg Asp Asp Val  
 20                      25                      30  
 Asp Tyr Gln Ile Phe Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe Ser  
 35                      40                      45  
 Val Gly Ala Thr Asn Val Leu Val Lys Asp Lys Asn Asn Lys Asp Leu  
 50                      55                      60  
 Gly Thr Ala Leu Pro Asn Gly Ile Pro Met Ile Asp Phe Ser Val Val  
 65                      70                      75                      80  
 Asp Val Asp Lys Arg Ile Ala Thr Leu Ile Asn Pro Gln Tyr Val Val  
 85                      90                      95  
 Gly Val Lys His Val Ser Asn Gly Val Ser Glu Leu His Phe Gly Asn  
 100                      105                      110  
 Leu Asn Gly Asn Met Asn Asn Gly Asn Ala Lys Ala His Arg Asp Val  
 115                      120                      125  
 Ser Ser Glu Glu Asn Arg Tyr Phe Ser Val Glu Lys Asn Glu Tyr Pro  
 130                      135                      140

Thr Lys Leu Asn Gly Lys Thr Val Thr Thr Glu Asp Gln Thr Gln Lys  
 145 150 155 160

Arg Arg Glu Asp Tyr Tyr Met Pro Arg Leu Asp Lys Phe Val Thr Glu  
 165 170 175

Val Ala Pro Ile Glu Ala Ser Thr Ala Ser Ser Asp Ala Gly Thr Tyr  
 180 185 190

Asn Asp Gln Asn Lys Tyr Pro Ala Phe Val Arg Leu Gly Ser Gly Ser  
 195 200 205

Gln Phe Ile Tyr Lys Lys Gly Asp Asn Tyr Ser Leu Ile Leu Asn Asn  
 210 215 220

His Glu Val Gly Gly Asn Asn Leu Lys Leu Val Gly Asp Ala Tyr Thr  
 225 230 235 240

Tyr Gly Ile Ala Gly Thr Pro Tyr Lys Val Asn His Glu Asn Asn Gly  
 245 250 255

Leu Ile Gly Phe Gly Asn Ser Lys Glu Glu His Ser Asp Pro Lys Gly  
 260 265 270

Ile Leu Ser Gln Asp Pro Leu Thr Asn Tyr Ala Val Leu Gly Asp Ser  
 275 280 285

Gly Ser Pro Leu Phe Val Tyr Asp Arg Glu Lys Gly Lys Trp Leu Phe  
 290 295 300

Leu Gly Ser Tyr Asp Phe Trp Ala Gly Tyr Asn Lys Lys Ser Trp Gln  
 305 310 315 320

Glu Trp Asn Ile Tyr Lys Ser Gln Phe Thr Lys Asp Val Leu Asn Lys  
 325 330 335

Asp Ser Ala Gly Ser Leu Ile Gly Ser Lys Thr Asp Tyr Ser Trp Ser  
 340 345 350

Ser Asn Gly Lys Thr Ser Thr Ile Thr Gly Gly Glu Lys Ser Leu Asn  
 355 360 365

Val Asp Leu Ala Asp Gly Lys Asp Lys Pro Asn His Gly Lys Ser Val  
 370 375 380

Thr Phe Glu Gly Ser Gly Thr Leu Thr Leu Asn Asn Asn Ile Asp Gln  
 385 390 395 400

Gly Ala Gly Gly Leu Phe Phe Glu Gly Asp Tyr Glu Val Lys Gly Thr  
 405 410 415

Ser Asp Asn Thr Thr Trp Lys Gly Ala Gly Val Ser Val Ala Glu Gly  
 420 425 430

Lys Thr Val Thr Trp Lys Val His Asn Pro Gln Tyr Asp Arg Leu Ala  
 435 440 445

Lys Ile Gly Lys Gly Thr Leu Ile Val Glu Gly Thr Gly Asp Asn Lys  
 450 455 460

Gly Ser Leu Lys Val Gly Asp Gly Thr Val Ile Leu Lys Gln Gln Thr  
 465 470 475 480

Asn Gly Ser Gly Gln His Ala Phe Ala Ser Val Gly Ile Val Ser Gly  
 485 490 495

Arg Ser Thr Leu Val Leu Asn Asp Asp Lys Gln Val Asp Pro Asn Ser  
 500 505 510

Ile Tyr Phe Gly Phe Arg Gly Gly Arg Leu Asp Leu Asn Gly Asn Ser  
 515 520 525

Leu Thr Phe Asp His Ile Arg Asn Ile Asp Asp Gly Ala Arg Leu Val  
 530 535 540

Asn His Asn Met Thr Asn Ala Ser Asn Ile Thr Ile Thr Gly Glu Ser  
 545 550 555 560

Leu Ile Thr Asp Pro Asn Thr Ile Thr Pro Tyr Asn Ile Asp Ala Pro  
 565 570 575

Asp Glu Asp Asn Pro Tyr Ala Phe Arg Arg Ile Lys Asp Gly Gly Gln  
 580 585 590

Leu Tyr Leu Asn Leu Glu Asn Tyr Thr Tyr Tyr Ala Leu Arg Lys Gly



595

600

605

Ala Ser Thr Arg Ser Glu Leu Pro Lys Asn Ser Gly Glu Ser Asn Glu  
610 615 620

Asn Trp Leu Tyr Met Gly Lys Thr Ser Asp Glu Ala Lys Arg Asn Val  
625 630 635 640

Met Asn His Ile Asn Asn Glu Arg Met Asn Gly Phe Asn Gly Tyr Phe  
645 650 655

Gly Glu Glu Glu Gly Lys Asn Asn Gly Asn Leu Asn Val Thr Phe Lys  
660 665 670

Gly Lys Ser Glu Gln Asn Arg Phe Leu Leu Thr Gly Gly Thr Asn Leu  
675 680 685

Asn Gly Asp Leu Thr Val Glu Lys Gly Thr Leu Phe Leu Ser Gly Arg  
690 695 700

Pro Thr Pro His Ala Arg Asp Ile Ala Gly Ile Ser Ser Thr Lys Lys  
705 710 715 720

Asp Pro His Phe Ala Glu Asn Asn Glu Val Val Val Glu Asp Asp Trp  
725 730 735

Ile Asn Arg Asn Phe Lys Ala Thr Thr Met Asn Val Thr Gly Asn Ala  
740 745 750

Ser Leu Tyr Ser Gly Arg Asn Val Ala Asn Ile Thr Ser Asn Ile Thr  
755 760 765

Ala Ser Asn Lys Ala Gln Val His Ile Gly Tyr Lys Thr Gly Asp Thr  
770 775 780

Val Cys Val Arg Ser Asp Tyr Thr Gly Tyr Val Thr Cys Thr Thr Asp  
785 790 795 800

Lys Leu Ser Asp Lys Ala Leu Asn Ser Phe Asn Pro Thr Asn Leu Arg  
805 810 815

Gly Asn Val Asn Leu Thr Glu Ser Ala Asn Phe Val Leu Gly Lys Ala  
820 825 830

Asn Leu Phe Gly Thr Ile Gln Ser Arg Gly Asn Ser Gln Val Arg Leu  
835 840 845

Thr Glu Asn Ser His Trp His Leu Thr Gly Asn Ser Asp Val His Gln  
850 855 860

Leu Asp Leu Ala Asn Gly His Ile His Leu Asn Ser Ala Asp Asn Ser  
865 870 875 880

Asn Asn Val Thr Lys Tyr Asn Thr Leu Thr Val Asn Ser Leu Ser Gly  
885 890 895

Asn Gly Ser Phe Tyr Tyr Leu Thr Asp Leu Ser Asn Lys Gln Gly Asp  
900 905 910

Lys Val Val Val Thr Lys Ser Ala Thr Gly Asn Phe Thr Leu Gln Val  
915 920 925

Ala Asp Lys Thr Gly Glu Pro Asn His Asn Glu Leu Thr Leu Phe Asp  
930 935 940

Ala Ser Lys Ala Gln Arg Asp His Leu Asn Val Ser Leu Val Gly Asn  
945 950 955 960

Thr Val Asp Leu Gly Ala Trp Lys Tyr Lys Leu Arg Asn Val Asn Gly  
965 970 975

Arg Tyr Asp Leu Tyr Asn Pro Glu Val Glu Lys Arg Asn Gln Thr Val  
980 985 990

Asp Thr Thr Asn Ile Thr Thr Pro Asn Asn Ile Gln Ala Asp Val Pro  
995 1000 1005

Ser Val Pro Ser Asn Asn Glu Glu Ile Ala Arg Val Asp Glu Ala  
1010 1015 1020

Pro Val Pro Pro Pro Ala Pro Ala Thr Pro Ser Glu Thr Thr Glu  
1025 1030 1035

Thr Val Ala Glu Asn Ser Lys Gln Glu Ser Lys Thr Val Glu Lys  
1040 1045 1050

|         |         |         |         |         |         |         |         |
|---------|---------|---------|---------|---------|---------|---------|---------|
| Asn Glu | Gln Asp | Ala Thr | Glu Thr | Thr Thr | Ala Gln | Asn Arg | Glu Val |
| 1055    |         |         | 1060    |         |         | 1065    |         |
| Ala Lys | Glu Ala | Lys Ser | Asn Val | Lys Ala | Asn Thr | Gln Thr | Asn     |
| 1070    |         |         | 1075    |         |         | 1080    |         |
| Glu Val | Ala Gln | Ser Gly | Ser Glu | Thr Lys | Glu Thr | Gln Thr | Thr     |
| 1085    |         |         | 1090    |         |         | 1095    |         |
| Glu Thr | Lys Glu | Thr Ala | Thr Val | Glu Lys | Glu Glu | Lys Ala | Lys     |
| 1100    |         |         | 1105    |         |         | 1110    |         |
| Val Glu | Thr Glu | Lys Thr | Gln Glu | Val Pro | Lys Val | Thr Ser | Gln     |
| 1115    |         |         | 1120    |         |         | 1125    |         |
| Val Ser | Pro Lys | Gln Glu | Gln Ser | Glu Thr | Val Gln | Pro Gln | Ala     |
| 1130    |         |         | 1135    |         |         | 1140    |         |
| Glu Pro | Ala Arg | Glu Asn | Asp Pro | Thr Val | Asn Ile | Lys Glu | Pro     |
| 1145    |         |         | 1150    |         |         | 1155    |         |
| Gln Ser | Gln Thr | Asn Thr | Thr Ala | Asp Thr | Glu Gln | Pro Ala | Lys     |
| 1160    |         |         | 1165    |         |         | 1170    |         |
| Glu Thr | Ser Ser | Asn Val | Glu Gln | Pro Val | Thr Glu | Ser Thr | Thr     |
| 1175    |         |         | 1180    |         |         | 1185    |         |
| Val Asn | Thr Gly | Asn Ser | Val Val | Glu Asn | Pro Glu | Asn Thr | Thr     |
| 1190    |         |         | 1195    |         |         | 1200    |         |
| Pro Ala | Thr Thr | Gln Pro | Thr Val | Asn Ser | Glu Ser | Ser Asn | Lys     |
| 1205    |         |         | 1210    |         |         | 1215    |         |
| Pro Lys | Asn Arg | His Arg | Arg Ser | Val Arg | Ser Val | Pro His | Asn     |
| 1220    |         |         | 1225    |         |         | 1230    |         |
| Val Glu | Pro Ala | Thr Thr | Ser Ser | Asn Asp | Arg Ser | Thr Val | Ala     |
| 1235    |         |         | 1240    |         |         | 1245    |         |
| Leu Cys | Asp Leu | Thr Ser | Thr Asn | Thr Asn | Ala Val | Leu Ser | Asp     |
| 1250    |         |         | 1255    |         |         | 1260    |         |

|         |         |         |      |         |         |         |         |     |  |
|---------|---------|---------|------|---------|---------|---------|---------|-----|--|
| Ala Arg | Ala Lys | Ala Gln | Phe  | Val     | Ala Leu | Asn Val | Gly Lys | Ala |  |
| 1265    |         |         | 1270 |         |         | 1275    |         |     |  |
| Val Ser | Gln His | Ile Ser | Gln  | Leu Glu | Met Asn | Asn     | Glu Gly | Gln |  |
| 1280    |         |         | 1285 |         |         | 1290    |         |     |  |
| Tyr Asn | Val Trp | Val Ser | Asn  | Thr Ser | Met Asn | Lys     | Asn Tyr | Ser |  |
| 1295    |         |         | 1300 |         |         | 1305    |         |     |  |
| Ser Ser | Gln Tyr | Arg Arg | Phe  | Ser Ser | Lys Ser | Thr     | Gln Thr | Gln |  |
| 1310    |         |         | 1315 |         |         | 1320    |         |     |  |
| Leu Gly | Trp Asp | Gln Thr | Ile  | Ser Asn | Asn Val | Gln     | Leu Gly | Gly |  |
| 1325    |         |         | 1330 |         |         | 1335    |         |     |  |
| Val Phe | Thr Tyr | Val Arg | Asn  | Ser Asn | Asn Phe | Asp     | Lys Ala | Thr |  |
| 1340    |         |         | 1345 |         |         | 1350    |         |     |  |
| Ser Lys | Asn Thr | Leu Ala | Gln  | Val Asn | Phe Tyr | Ser     | Lys Tyr | Tyr |  |
| 1355    |         |         | 1360 |         |         | 1365    |         |     |  |
| Ala Asp | Asn His | Trp Tyr | Leu  | Gly Ile | Asp Leu | Gly     | Tyr Gly | Lys |  |
| 1370    |         |         | 1375 |         |         | 1380    |         |     |  |
| Phe Gln | Ser Lys | Leu Gln | Thr  | Asn His | Asn Ala | Lys     | Phe Ala | Arg |  |
| 1385    |         |         | 1390 |         |         | 1395    |         |     |  |
| His Thr | Ala Gln | Phe Gly | Leu  | Thr Ala | Gly Lys | Ala     | Phe Asn | Leu |  |
| 1400    |         |         | 1405 |         |         | 1410    |         |     |  |
| Gly Asn | Phe Gly | Ile Thr | Pro  | Ile Val | Gly Val | Arg     | Tyr Ser | Tyr |  |
| 1415    |         |         | 1420 |         |         | 1425    |         |     |  |
| Leu Ser | Asn Ala | Asp Phe | Ala  | Leu Asp | Gln Ala | Arg     | Ile Lys | Val |  |
| 1430    |         |         | 1435 |         |         | 1440    |         |     |  |
| Asn Pro | Ile Ser | Val Lys | Thr  | Ala Phe | Ala Gln | Val     | Asp Leu | Ser |  |
| 1445    |         |         | 1450 |         |         | 1455    |         |     |  |
| Tyr Thr | Tyr His | Leu Gly | Glu  | Phe Ser | Val Thr | Pro     | Ile Leu | Ser |  |
| 1460    |         |         | 1465 |         |         | 1470    |         |     |  |
| Ala Arg | Tyr Asp | Ala Asn | Gln  | Gly Ser | Gly Lys | Ile     | Asn Val | Asn |  |

1475                      1480                      1485  
 Gly Tyr Asp Phe Ala Tyr Asn Val Glu Asn Gln Gln Gln Tyr Asn  
 1490                      1495                      1500  
 Ala Gly Leu Lys Leu Lys Tyr His Asn Val Lys Leu Ser Leu Ile  
 1505                      1510                      1515  
 Gly Gly Leu Thr Lys Ala Lys Gln Ala Glu Lys Gln Lys Thr Ala  
 1520                      1525                      1530  
 Glu Leu Lys Leu Ser Phe Ser Phe  
 1535                      1540  
 <210> 4  
 <211> 1545  
 <212> PRT  
 <213> Haemophilus influenzae  
 <400> 4  
 Met Leu Asn Lys Lys Phe Lys Leu Asn Phe Ile Ala Leu Thr Val Ala  
 1                      5                      10                      15  
 Tyr Ala Leu Thr Pro Tyr Thr Glu Ala Ala Leu Val Arg Asp Asp Val  
 20                      25                      30  
 Asp Tyr Gln Ile Phe Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe Ser  
 35                      40                      45  
 Val Gly Ala Thr Asn Val Glu Val Arg Asp Lys Asn Asn Arg Pro Leu  
 50                      55                      60  
 Gly Asn Val Leu Pro Asn Gly Ile Pro Met Ile Asp Phe Ser Val Val  
 65                      70                      75                      80  
 Asp Val Asp Lys Arg Ile Ala Thr Leu Val Asn Pro Gln Tyr Val Val  
 85                      90                      95  
 Gly Val Lys His Val Ser Asn Gly Val Ser Glu Leu His Phe Gly Asn  
 100                      105                      110  
 Leu Asn Gly Asn Met Asn Asn Gly Asn Ala Lys Ala His Arg Asp Val  
 115                      120                      125

Ser Ser Glu Glu Asn Arg Tyr Tyr Thr Val Glu Lys Asn Glu Tyr Pro  
 130 135 140

Thr Lys Leu Asn Gly Lys Ala Val Thr Thr Glu Asp Gln Ala Gln Lys  
 145 150 155 160

Arg Arg Glu Asp Tyr Tyr Met Pro Arg Leu Asp Lys Phe Val Thr Glu  
 165 170 175

Val Ala Pro Ile Glu Ala Ser Thr Asp Ser Ser Thr Ala Gly Thr Tyr  
 180 185 190

Asn Asn Lys Asp Lys Tyr Pro Tyr Phe Val Arg Leu Gly Ser Gly Thr  
 195 200 205

Gln Phe Ile Tyr Glu Asn Gly Thr Arg Tyr Glu Leu Trp Leu Gly Lys  
 210 215 220

Glu Gly Gln Lys Ser Asp Ala Gly Gly Tyr Asn Leu Lys Leu Val Gly  
 225 230 235 240

Asn Ala Tyr Thr Tyr Gly Ile Ala Gly Thr Pro Tyr Glu Val Asn His  
 245 250 255

Glu Asn Asp Gly Leu Ile Gly Phe Gly Asn Ser Asn Asn Glu Tyr Ile  
 260 265 270

Asn Pro Lys Glu Ile Leu Ser Lys Lys Pro Leu Thr Asn Tyr Ala Val  
 275 280 285

Leu Gly Asp Ser Gly Ser Pro Leu Phe Val Tyr Asp Arg Glu Lys Gly  
 290 295 300

Lys Trp Leu Phe Leu Gly Ser Tyr Asp Tyr Trp Ala Gly Tyr Asn Lys  
 305 310 315 320

Lys Ser Trp Gln Glu Trp Asn Ile Tyr Lys Pro Glu Phe Ala Glu Lys  
 325 330 335

Ile Tyr Glu Gln Tyr Ser Ala Gly Ser Leu Ile Gly Ser Lys Thr Asp  
 340 345 350

Tyr Ser Trp Ser Ser Asn Gly Lys Thr Ser Thr Ile Thr Gly Gly Glu  
 355 360 365

Lys Ser Leu Asn Val Asp Leu Ala Asp Gly Lys Asp Lys Pro Asn His  
 370 375 380

Gly Lys Ser Val Thr Phe Glu Gly Ser Gly Thr Leu Thr Leu Asn Asn  
 385 390 395 400

Asn Ile Asp Gln Gly Ala Gly Gly Leu Phe Phe Glu Gly Asp Tyr Glu  
 405 410 415

Val Lys Gly Thr Ser Asp Asn Thr Thr Trp Lys Gly Ala Gly Val Ser  
 420 425 430

Val Ala Glu Gly Lys Thr Val Thr Trp Lys Val His Asn Pro Gln Tyr  
 435 440 445

Asp Arg Leu Ala Lys Ile Gly Lys Gly Thr Leu Ile Val Glu Gly Thr  
 450 455 460

Gly Asp Asn Lys Gly Ser Leu Lys Val Gly Asp Gly Thr Val Ile Leu  
 465 470 475 480

Lys Gln Gln Thr Asn Gly Ser Gly Gln His Ala Phe Ala Ser Val Gly  
 485 490 495

Ile Val Ser Gly Arg Ser Thr Leu Val Leu Asn Asp Asp Lys Gln Val  
 500 505 510

Asp Pro Asn Ser Ile Tyr Phe Gly Phe Arg Gly Gly Arg Leu Asp Leu  
 515 520 525

Asn Gly Asn Ser Leu Thr Phe Asp His Ile Arg Asn Ile Asp Glu Gly  
 530 535 540

Ala Arg Leu Val Asn His Ser Thr Ser Lys His Ser Thr Val Thr Ile  
 545 550 555 560

Thr Gly Asp Asn Leu Ile Thr Asp Pro Asn Asn Val Ser Ile Tyr Tyr  
 565 570 575

Val Lys Pro Leu Glu Asp Asp Asn Pro Tyr Ala Ile Arg Gln Ile Lys

| 580 |     |     |     |     | 585 |     |     |     |     | 590 |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Tyr | Gly | Tyr | Gln | Leu | Tyr | Phe | Asn | Glu | Glu | Asn | Arg | Thr | Tyr | Tyr | Ala |
|     | 595 |     |     |     |     |     | 600 |     |     |     |     | 605 |     |     |     |
| Leu | Lys | Lys | Asp | Ala | Ser | Ile | Arg | Ser | Glu | Phe | Pro | Gln | Asn | Arg | Gly |
|     | 610 |     |     |     |     | 615 |     |     |     |     | 620 |     |     |     |     |
| Glu | Ser | Asn | Asn | Ser | Trp | Leu | Tyr | Met | Gly | Thr | Glu | Lys | Ala | Asp | Ala |
| 625 |     |     |     |     | 630 |     |     |     |     | 635 |     |     |     |     | 640 |
| Gln | Lys | Asn | Ala | Met | Asn | His | Ile | Asn | Asn | Glu | Arg | Met | Asn | Gly | Phe |
|     |     |     |     | 645 |     |     |     |     | 650 |     |     |     |     | 655 |     |
| Asn | Gly | Tyr | Phe | Gly | Glu | Glu | Glu | Gly | Lys | Asn | Asn | Gly | Asn | Leu | Asn |
|     |     |     | 660 |     |     |     |     | 665 |     |     |     |     | 670 |     |     |
| Val | Thr | Phe | Lys | Gly | Lys | Ser | Glu | Gln | Asn | Arg | Phe | Leu | Leu | Thr | Gly |
|     | 675 |     |     |     |     |     | 680 |     |     |     |     | 685 |     |     |     |
| Gly | Thr | Asn | Leu | Asn | Gly | Asp | Leu | Asn | Val | Gln | Gln | Gly | Thr | Leu | Phe |
|     | 690 |     |     |     |     | 695 |     |     |     |     | 700 |     |     |     |     |
| Leu | Ser | Gly | Arg | Pro | Thr | Pro | His | Ala | Arg | Asp | Ile | Ala | Gly | Ile | Ser |
| 705 |     |     |     |     | 710 |     |     |     |     | 715 |     |     |     |     | 720 |
| Ser | Thr | Lys | Lys | Asp | Ser | His | Phe | Ser | Glu | Asn | Asn | Glu | Val | Val | Val |
|     |     |     |     | 725 |     |     |     |     | 730 |     |     |     |     | 735 |     |
| Glu | Asp | Asp | Trp | Ile | Asn | Arg | Asn | Phe | Lys | Ala | Thr | Asn | Ile | Asn | Val |
|     |     |     | 740 |     |     |     |     | 745 |     |     |     |     | 750 |     |     |
| Thr | Asn | Asn | Ala | Thr | Leu | Tyr | Ser | Gly | Arg | Asn | Val | Glu | Ser | Ile | Thr |
|     | 755 |     |     |     |     |     | 760 |     |     |     |     | 765 |     |     |     |
| Ser | Asn | Ile | Thr | Ala | Ser | Asn | Asn | Ala | Lys | Val | His | Ile | Gly | Tyr | Lys |
|     | 770 |     |     |     |     | 775 |     |     |     |     | 780 |     |     |     |     |
| Ala | Gly | Asp | Thr | Val | Cys | Val | Arg | Ser | Asp | Tyr | Thr | Gly | Tyr | Val | Thr |
| 785 |     |     |     |     | 790 |     |     |     |     | 795 |     |     |     |     | 800 |
| Cys | Thr | Thr | Asp | Lys | Leu | Ser | Asp | Lys | Ala | Leu | Asn | Ser | Phe | Asn | Pro |
|     |     |     |     | 805 |     |     |     |     | 810 |     |     |     |     | 815 |     |



Thr Asn Leu Arg Gly Asn Val Asn Leu Thr Glu Ser Ala Asn Phe Val  
820 825 830

Leu Gly Lys Ala Asn Leu Phe Gly Thr Ile Gln Ser Arg Gly Asn Ser  
835 840 845

Gln Val Arg Leu Thr Glu Asn Ser His Trp His Leu Thr Gly Asn Ser  
850 855 860

Asp Val His Gln Leu Asp Leu Ala Asn Gly His Ile His Leu Asn Ser  
865 870 875 880

Ala Asp Asn Ser Asn Asn Val Thr Lys Tyr Asn Thr Leu Thr Val Asn  
885 890 895

Ser Leu Ser Gly Asn Gly Ser Phe Tyr Tyr Leu Thr Asp Leu Ser Asn  
900 905 910

Lys Gln Gly Asp Lys Val Val Val Thr Lys Ser Ala Thr Gly Asn Phe  
915 920 925

Thr Leu Gln Val Ala Asp Lys Thr Gly Glu Pro Asn His Asn Glu Leu  
930 935 940

Thr Leu Phe Asp Ala Ser Lys Ala Gln Arg Asp His Leu Asn Val Ser  
945 950 955 960

Leu Val Gly Asn Thr Val Asp Leu Gly Ala Trp Lys Tyr Lys Leu Arg  
965 970 975

Asn Val Asn Gly Arg Tyr Asp Leu Tyr Asn Pro Glu Val Glu Lys Arg  
980 985 990

Asn Gln Thr Val Asp Thr Thr Asn Ile Thr Thr Pro Asn Asn Ile Gln  
995 1000 1005

Ala Asp Val Pro Ser Val Pro Ser Asn Asn Glu Glu Ile Ala Arg  
1010 1015 1020

Val Asp Glu Ala Pro Val Pro Pro Pro Ala Pro Ala Thr Pro Ser  
1025 1030 1035

|         |                     |                     |                     |             |
|---------|---------------------|---------------------|---------------------|-------------|
| Glu Thr | Thr Glu Thr Val     | Ala                 | Glu Asn Ser Lys Gln | Glu Ser Lys |
| 1040    |                     | 1045                |                     | 1050        |
| Thr Val | Glu Lys Asn Glu Gln | Asp Ala Thr Glu Thr | Thr Ala Gln         |             |
| 1055    |                     | 1060                |                     | 1065        |
| Asn Arg | Glu Val Ala Lys Glu | Ala Lys Ser Asn Val | Lys Ala Asn         |             |
| 1070    |                     | 1075                |                     | 1080        |
| Thr Gln | Thr Asn Glu Val Ala | Gln Ser Gly Ser Glu | Thr Lys Glu         |             |
| 1085    |                     | 1090                |                     | 1095        |
| Thr Gln | Thr Thr Glu Thr Lys | Glu Thr Ala Thr Val | Glu Lys Glu         |             |
| 1100    |                     | 1105                |                     | 1110        |
| Glu Lys | Ala Lys Val Glu Thr | Glu Lys Thr Gln Glu | Val Pro Lys         |             |
| 1115    |                     | 1120                |                     | 1125        |
| Val Thr | Ser Gln Val Ser Pro | Lys Gln Glu Gln Ser | Glu Thr Val         |             |
| 1130    |                     | 1135                |                     | 1140        |
| Gln Pro | Gln Ala Glu Pro Ala | Arg Glu Asn Asp Pro | Thr Val Asn         |             |
| 1145    |                     | 1150                |                     | 1155        |
| Ile Lys | Glu Pro Gln Ser Gln | Thr Asn Thr Thr Ala | Asp Thr Glu         |             |
| 1160    |                     | 1165                |                     | 1170        |
| Gln Pro | Ala Lys Glu Thr Ser | Ser Asn Val Glu Gln | Pro Val Thr         |             |
| 1175    |                     | 1180                |                     | 1185        |
| Glu Ser | Thr Thr Val Asn Thr | Gly Asn Ser Val Val | Glu Asn Pro         |             |
| 1190    |                     | 1195                |                     | 1200        |
| Glu Asn | Thr Thr Pro Ala Thr | Thr Gln Pro Thr Val | Asn Ser Glu         |             |
| 1205    |                     | 1210                |                     | 1215        |
| Ser Ser | Asn Lys Pro Lys Asn | Arg His Arg Arg Ser | Val Arg Ser         |             |
| 1220    |                     | 1225                |                     | 1230        |
| Val Pro | His Asn Val Glu Pro | Ala Thr Thr Ser Ser | Asn Asp Arg         |             |
| 1235    |                     | 1240                |                     | 1245        |

|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|
| Ser  | Thr | Val | Ala | Leu | Cys | Asp  | Leu | Thr | Ser | Thr | Asn  | Thr | Asn | Ala |
| 1250 |     |     |     |     |     | 1255 |     |     |     |     | 1260 |     |     |     |
| Val  | Leu | Ser | Asp | Ala | Arg | Ala  | Lys | Ala | Gln | Phe | Val  | Ala | Leu | Asn |
| 1265 |     |     |     |     |     | 1270 |     |     |     |     | 1275 |     |     |     |
| Val  | Gly | Lys | Ala | Val | Ser | Gln  | His | Ile | Ser | Gln | Leu  | Glu | Met | Asn |
| 1280 |     |     |     |     |     | 1285 |     |     |     |     | 1290 |     |     |     |
| Asn  | Glu | Gly | Gln | Tyr | Asn | Val  | Trp | Val | Ser | Asn | Thr  | Ser | Met | Asn |
| 1295 |     |     |     |     |     | 1300 |     |     |     |     | 1305 |     |     |     |
| Lys  | Asn | Tyr | Ser | Ser | Ser | Gln  | Tyr | Arg | Arg | Phe | Ser  | Ser | Lys | Ser |
| 1310 |     |     |     |     |     | 1315 |     |     |     |     | 1320 |     |     |     |
| Thr  | Gln | Thr | Gln | Leu | Gly | Trp  | Asp | Gln | Thr | Ile | Ser  | Asn | Asn | Val |
| 1325 |     |     |     |     |     | 1330 |     |     |     |     | 1335 |     |     |     |
| Gln  | Leu | Gly | Gly | Val | Phe | Thr  | Tyr | Val | Arg | Asn | Ser  | Asn | Asn | Phe |
| 1340 |     |     |     |     |     | 1345 |     |     |     |     | 1350 |     |     |     |
| Asp  | Lys | Ala | Thr | Ser | Lys | Asn  | Thr | Leu | Ala | Gln | Val  | Asn | Phe | Tyr |
| 1355 |     |     |     |     |     | 1360 |     |     |     |     | 1365 |     |     |     |
| Ser  | Lys | Tyr | Tyr | Ala | Asp | Asn  | His | Trp | Tyr | Leu | Gly  | Ile | Asp | Leu |
| 1370 |     |     |     |     |     | 1375 |     |     |     |     | 1380 |     |     |     |
| Gly  | Tyr | Gly | Lys | Phe | Gln | Ser  | Lys | Leu | Gln | Thr | Asn  | His | Asn | Ala |
| 1385 |     |     |     |     |     | 1390 |     |     |     |     | 1395 |     |     |     |
| Lys  | Phe | Ala | Arg | His | Thr | Ala  | Gln | Phe | Gly | Leu | Thr  | Ala | Gly | Lys |
| 1400 |     |     |     |     |     | 1405 |     |     |     |     | 1410 |     |     |     |
| Ala  | Phe | Asn | Leu | Gly | Asn | Phe  | Gly | Ile | Thr | Pro | Ile  | Val | Gly | Val |
| 1415 |     |     |     |     |     | 1420 |     |     |     |     | 1425 |     |     |     |
| Arg  | Tyr | Ser | Tyr | Leu | Ser | Asn  | Ala | Asp | Phe | Ala | Leu  | Asp | Gln | Ala |
| 1430 |     |     |     |     |     | 1435 |     |     |     |     | 1440 |     |     |     |
| Arg  | Ile | Lys | Val | Asn | Pro | Ile  | Ser | Val | Lys | Thr | Ala  | Phe | Ala | Gln |
| 1445 |     |     |     |     |     | 1450 |     |     |     |     | 1455 |     |     |     |
| Val  | Asp | Leu | Ser | Tyr | Thr | Tyr  | His | Leu | Gly | Glu | Phe  | Ser | Val | Thr |

|   |     |      |     |      |
|---|-----|------|-----|------|
| 1460  |     | 1465 |     | 1470 |
| Pro Ile Leu Ser Ala Arg Tyr Asp Ala Asn Gln Gly Ser Gly Lys     |     |      |     |      |
| 1475  |     | 1480 |     | 1485 |
| Ile Asn Val Asn Gly Tyr Asp Phe Ala Tyr Asn Val Glu Asn Gln     |     |      |     |      |
| 1490  |     | 1495 |     | 1500 |
| Gln Gln Tyr Asn Ala Gly Leu Lys Leu Lys Tyr His Asn Val Lys     |     |      |     |      |
| 1505  |     | 1510 |     | 1515 |
| Leu Ser Leu Ile Gly Gly Leu Thr Lys Ala Lys Gln Ala Glu Lys     |     |      |     |      |
| 1520  |     | 1525 |     | 1530 |
| Gln Lys Thr Ala Glu Leu Lys Leu Ser Phe Ser Phe                 |     |      |     |      |
| 1535  |     | 1540 |     | 1545 |
| <210> 5   |     |      |     |      |
| <211> 1702  |     |      |     |      |
| <212> PRT   |     |      |     |      |
| <213> Haemophilus influenzae                                    |     |      |     |      |
| <400> 5   |     |      |     |      |
| Met Leu Asn Lys Lys Phe Lys Leu Asn Phe Ile Ala Leu Thr Val Ala |     |      |     |      |
| 1   | 5   |      | 10  | 15   |
| Tyr Ala Leu Thr Pro Tyr Thr Glu Ala Ala Leu Val Arg Asp Asp Val |     |      |     |      |
|   | 20  |      | 25  | 30   |
| Asp Tyr Gln Ile Phe Arg Asp Phe Ala Glu Asn Lys Gly Arg Phe Ser |     |      |     |      |
|   | 35  |      | 40  | 45   |
| Val Gly Ala Thr Asn Val Glu Val Arg Asp Lys Asn Asn His Ser Leu |     |      |     |      |
|   | 50  |      | 55  | 60   |
| Gly Asn Val Leu Pro Asn Gly Ile Pro Met Ile Asp Phe Ser Val Val |     |      |     |      |
| 65  |     | 70   | 75  | 80   |
| Asp Val Asp Lys Arg Ile Ala Thr Leu Ile Asn Pro Gln Tyr Val Val |     |      |     |      |
|   | 85  |      | 90  | 95   |
| Gly Val Lys His Val Ser Asn Gly Val Ser Glu Leu His Phe Gly Asn |     |      |     |      |
|   | 100 |      | 105 | 110  |

Leu Asn Gly Asn Met Asn Asn Gly Asn Asp Lys Ser His Arg Asp Val  
115 120 125

Ser Ser Glu Glu Asn Arg Tyr Phe Ser Val Glu Lys Asn Glu Tyr Pro  
130 135 140

Thr Lys Leu Asn Gly Lys Ala Val Thr Thr Glu Asp Gln Thr Gln Lys  
145 150 155 160

Arg Arg Glu Asp Tyr Tyr Met Pro Arg Leu Asp Lys Phe Val Thr Glu  
165 170 175

Val Ala Pro Ile Glu Ala Ser Thr Ala Ser Ser Asp Ala Gly Thr Tyr  
180 185 190

Asn Asp Gln Asn Lys Tyr Pro Ala Phe Val Arg Leu Gly Ser Gly Thr  
195 200 205

Gln Phe Ile Tyr Lys Lys Gly Asp Asn Tyr Ser Leu Ile Leu Asn Asn  
210 215 220

His Glu Val Gly Gly Asn Asn Leu Lys Leu Val Gly Asp Ala Tyr Thr  
225 230 235 240

Tyr Gly Ile Ala Gly Thr Pro Tyr Lys Val Asn His Glu Asn Asn Gly  
245 250 255

Leu Ile Gly Phe Gly Asn Ser Lys Glu Glu His Ser Asp Pro Lys Gly  
260 265 270

Ile Leu Ser Gln Asp Pro Leu Thr Asn Tyr Ala Val Leu Gly Asp Ser  
275 280 285

Gly Ser Pro Leu Phe Val Tyr Asp Arg Glu Lys Gly Lys Trp Leu Phe  
290 295 300

Leu Gly Ser Tyr Asp Phe Trp Ala Gly Tyr Asn Lys Lys Ser Trp Gln  
305 310 315 320

Glu Trp Asn Ile Tyr Lys Pro Glu Phe Ala Lys Thr Val Leu Asp Lys  
325 330 335

Asp Thr Ala Gly Ser Leu Ile Gly Ser Asn Thr Gln Tyr Asn Trp Asn  
340 345 350

Pro Thr Gly Lys Thr Ser Val Ile Ser Asn Gly Ser Glu Ser Leu Asn  
355 360 365

Val Asp Leu Phe Asp Ser Ser Gln Asp Thr Asp Ser Lys Lys Asn Asn  
370 375 380

His Gly Lys Ser Val Thr Leu Arg Gly Ser Gly Thr Leu Thr Leu Asn  
385 390 395 400

Asn Asn Ile Asp Gln Gly Ala Gly Gly Leu Phe Phe Glu Gly Asp Tyr  
405 410 415

Glu Val Lys Gly Thr Ser Asp Ser Thr Thr Trp Lys Gly Ala Gly Val  
420 425 430

Ser Val Ala Asp Gly Lys Thr Val Thr Trp Lys Val His Asn Pro Lys  
435 440 445

Ser Asp Arg Leu Ala Lys Ile Gly Lys Gly Thr Leu Ile Val Glu Gly  
450 455 460

Lys Gly Glu Asn Lys Gly Ser Leu Lys Val Gly Asp Gly Thr Val Ile  
465 470 475 480

Leu Lys Gln Gln Ala Asp Ala Asn Asn Lys Val Lys Ala Phe Ser Gln  
485 490 495

Val Gly Ile Val Ser Gly Arg Ser Thr Val Val Leu Asn Asp Asp Lys  
500 505 510

Gln Val Asp Pro Asn Ser Ile Tyr Phe Gly Phe Arg Gly Gly Arg Leu  
515 520 525

Asp Ala Asn Gly Asn Asn Leu Thr Phe Glu His Ile Arg Asn Ile Asp  
530 535 540

Asp Gly Ala Arg Leu Val Asn His Asn Thr Ser Lys Thr Ser Thr Val  
545 550 555 560

Thr Ile Thr Gly Glu Ser Leu Ile Thr Asp Pro Asn Thr Ile Thr Pro

565

570

575

Tyr Asn Ile Asp Ala Pro Asp Glu Asp Asn Pro Tyr Ala Phe Arg Arg  
580 585 590

Ile Lys Asp Gly Gly Gln Leu Tyr Leu Asn Leu Glu Asn Tyr Thr Tyr  
595 600 605

Tyr Ala Leu Arg Lys Gly Ala Ser Thr Arg Ser Glu Leu Pro Lys Asn  
610 615 620

Ser Gly Glu Ser Asn Glu Asn Trp Leu Tyr Met Gly Lys Thr Ser Asp  
625 630 635 640

Ala Ala Lys Arg Asn Val Met Asn His Ile Asn Asn Glu Arg Met Asn  
645 650 655

Gly Phe Asn Gly Tyr Phe Gly Glu Glu Glu Gly Lys Asn Asn Gly Asn  
660 665 670

Leu Asn Val Thr Phe Lys Gly Lys Ser Glu Gln Asn Arg Phe Leu Leu  
675 680 685

Thr Gly Gly Thr Asn Leu Asn Gly Asp Leu Lys Val Glu Lys Gly Thr  
690 695 700

Leu Phe Leu Ser Gly Arg Pro Thr Pro His Ala Arg Asp Ile Ala Gly  
705 710 715 720

Ile Ser Ser Thr Lys Lys Asp Gln His Phe Ala Glu Asn Asn Glu Val  
725 730 735

Val Val Glu Asp Asp Trp Ile Asn Arg Asn Phe Lys Ala Thr Asn Ile  
740 745 750

Asn Val Thr Asn Asn Ala Thr Leu Tyr Ser Gly Arg Asn Val Ala Asn  
755 760 765

Ile Thr Ser Asn Ile Thr Ala Ser Asp Asn Ala Lys Val His Ile Gly  
770 775 780

Tyr Lys Ala Gly Asp Thr Val Cys Val Arg Ser Asp Tyr Thr Gly Tyr  
785 790 795 800

Val Thr Cys Thr Thr Asp Lys Leu Ser Asp Lys Ala Leu Asn Ser Phe  
805 810 815

Asn Ala Thr Asn Val Ser Gly Asn Val Asn Leu Ser Gly Asn Ala Asn  
820 825 830

Phe Val Leu Gly Lys Ala Asn Leu Phe Gly Thr Ile Ser Gly Thr Gly  
835 840 845

Asn Ser Gln Val Arg Leu Thr Glu Asn Ser His Trp His Leu Thr Gly  
850 855 860

Asp Ser Asn Val Asn Gln Leu Asn Leu Asp Lys Gly His Ile His Leu  
865 870 875 880

Asn Ala Gln Asn Asp Ala Asn Lys Val Thr Thr Tyr Asn Thr Leu Thr  
885 890 895

Val Asn Ser Leu Ser Gly Asn Gly Ser Phe Tyr Tyr Leu Thr Asp Leu  
900 905 910

Ser Asn Lys Gln Gly Asp Lys Val Val Val Thr Lys Ser Ala Thr Gly  
915 920 925

Asn Phe Thr Leu Gln Val Ala Asp Lys Thr Gly Glu Pro Thr Lys Asn  
930 935 940

Glu Leu Thr Leu Phe Asp Ala Ser Asn Ala Thr Arg Asn Asn Leu Asn  
945 950 955 960

Val Ser Leu Val Gly Asn Thr Val Asp Leu Gly Ala Trp Lys Tyr Lys  
965 970 975

Leu Arg Asn Val Asn Gly Arg Tyr Asp Leu Tyr Asn Pro Glu Val Glu  
980 985 990

Lys Arg Asn Gln Thr Val Asp Thr Thr Asn Ile Thr Thr Pro Asn Asn  
995 1000 1005

Ile Gln Ala Asp Val Pro Ser Val Pro Ser Asn Asn Glu Glu Ile  
1010 1015 1020



|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|
| Ala  | Arg | Val | Glu | Thr | Pro | Val  | Pro | Pro | Pro | Ala | Pro  | Ala | Thr | Pro |
| 1025 |     |     |     |     |     | 1030 |     |     |     |     | 1035 |     |     |     |
| Ser  | Glu | Thr | Thr | Glu | Thr | Val  | Ala | Glu | Asn | Ser | Lys  | Gln | Glu | Ser |
| 1040 |     |     |     |     |     | 1045 |     |     |     |     | 1050 |     |     |     |
| Lys  | Thr | Val | Glu | Lys | Asn | Glu  | Gln | Asp | Ala | Thr | Glu  | Thr | Thr | Ala |
| 1055 |     |     |     |     |     | 1060 |     |     |     |     | 1065 |     |     |     |
| Gln  | Asn | Gly | Glu | Val | Ala | Glu  | Glu | Ala | Lys | Pro | Ser  | Val | Lys | Ala |
| 1070 |     |     |     |     |     | 1075 |     |     |     |     | 1080 |     |     |     |
| Asn  | Thr | Gln | Thr | Asn | Glu | Val  | Ala | Gln | Ser | Gly | Ser  | Glu | Thr | Glu |
| 1085 |     |     |     |     |     | 1090 |     |     |     |     | 1095 |     |     |     |
| Glu  | Thr | Gln | Thr | Thr | Glu | Ile  | Lys | Glu | Thr | Ala | Lys  | Val | Glu | Lys |
| 1100 |     |     |     |     |     | 1105 |     |     |     |     | 1110 |     |     |     |
| Glu  | Glu | Lys | Ala | Lys | Val | Glu  | Lys | Glu | Glu | Lys | Ala  | Lys | Val | Glu |
| 1115 |     |     |     |     |     | 1120 |     |     |     |     | 1125 |     |     |     |
| Lys  | Asp | Glu | Ile | Gln | Glu | Ala  | Pro | Gln | Met | Ala | Ser  | Glu | Thr | Ser |
| 1130 |     |     |     |     |     | 1135 |     |     |     |     | 1140 |     |     |     |
| Pro  | Lys | Gln | Ala | Lys | Pro | Ala  | Pro | Lys | Glu | Val | Ser  | Thr | Asp | Thr |
| 1145 |     |     |     |     |     | 1150 |     |     |     |     | 1155 |     |     |     |
| Lys  | Val | Glu | Glu | Thr | Gln | Val  | Gln | Ala | Gln | Pro | Gln  | Thr | Gln | Ser |
| 1160 |     |     |     |     |     | 1165 |     |     |     |     | 1170 |     |     |     |
| Thr  | Thr | Val | Ala | Ala | Ala | Glu  | Ala | Thr | Ser | Pro | Asn  | Ser | Lys | Pro |
| 1175 |     |     |     |     |     | 1180 |     |     |     |     | 1185 |     |     |     |
| Ala  | Glu | Glu | Thr | Gln | Pro | Ser  | Glu | Lys | Thr | Asn | Ala  | Glu | Pro | Val |
| 1190 |     |     |     |     |     | 1195 |     |     |     |     | 1200 |     |     |     |
| Thr  | Pro | Val | Val | Ser | Lys | Asn  | Gln | Thr | Glu | Asn | Thr  | Thr | Asp | Gln |
| 1205 |     |     |     |     |     | 1210 |     |     |     |     | 1215 |     |     |     |
| Pro  | Thr | Glu | Arg | Glu | Lys | Thr  | Ala | Lys | Val | Glu | Thr  | Glu | Lys | Thr |
| 1220 |     |     |     |     |     | 1225 |     |     |     |     | 1230 |     |     |     |

Gln Glu    Pro Pro Gln Val    Ala    Ser Gln Ala Ser Pro    Lys Gln Glu  
          1235                   1240                   1245

|     |      |     |     |     |     |      |     |     |     |     |      |     |     |     |
|-----|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|
| Val | Pro  | Thr | Val | Asn | Asn | Ala  | Glu | Glu | Val | Gln | Ala  | Gln | Leu | Gln |
|     | 1265 |     |     |     |     | 1270 |     |     |     |     | 1275 |     |     |     |

Asn Ser Ile Asn Thr Gly Ser Ala Thr Ala Ile Thr Glu Thr Ala  
1295 1300 1305

Asp Ala Ser Gln His Lys Ala Asn Thr Val Ala Asp Asn Ser Val  
1325 1330 1335

Ser Ile Ser Gln Pro Gln Glu Thr Ser Ala Glu Glu Thr Thr Ala  
1355 1360 1365

Lys Pro Asn Arg Arg Ser Arg Arg Ser Val Arg Ser Glu Pro Thr  
1385 1390 1395

Thr Ser Thr Asn Thr Asn Ala Val Ile Ser Asp Ala Met Ala Lys  
1415 1420 1425

Ile Ser Gln Leu Glu Met Asn Asn Glu Gly Gln Tyr Asn Val Trp

|                         |                         |             |  |      |
|-------------------------|-------------------------|-------------|--|------|
| 1445                    |                         | 1450        |  | 1455 |
| Val Ser Asn Thr Ser Met | Asn Glu Asn Tyr Ser Ser | Ser Gln Tyr |  |      |
| 1460                    | 1465                    | 1470        |  |      |
| Arg Arg Phe Ser Ser Lys | Ser Thr Gln Thr Gln Leu | Gly Trp Asp |  |      |
| 1475                    | 1480                    | 1485        |  |      |
| Gln Thr Ile Ser Asn Asn | Val Gln Leu Gly Gly Val | Phe Thr Tyr |  |      |
| 1490                    | 1495                    | 1500        |  |      |
| Val Arg Asn Ser Asn Asn | Phe Asp Lys Ala Ser Ser | Lys Asn Thr |  |      |
| 1505                    | 1510                    | 1515        |  |      |
| Leu Ala Gln Val Asn Phe | Tyr Ser Lys Tyr Tyr Ala | Asp Asn His |  |      |
| 1520                    | 1525                    | 1530        |  |      |
| Trp Tyr Leu Gly Ile Asp | Leu Gly Tyr Gly Lys Phe | Gln Ser Asn |  |      |
| 1535                    | 1540                    | 1545        |  |      |
| Leu Lys Thr Asn His Asn | Ala Lys Phe Ala Arg His | Thr Ala Gln |  |      |
| 1550                    | 1555                    | 1560        |  |      |
| Phe Gly Leu Thr Ala Gly | Lys Ala Phe Asn Leu Gly | Asn Phe Gly |  |      |
| 1565                    | 1570                    | 1575        |  |      |
| Ile Thr Pro Ile Val Gly | Val Arg Tyr Ser Tyr Leu | Ser Asn Ala |  |      |
| 1580                    | 1585                    | 1590        |  |      |
| Asn Phe Ala Leu Ala Lys | Asp Arg Ile Lys Val Asn | Pro Ile Ser |  |      |
| 1595                    | 1600                    | 1605        |  |      |
| Val Lys Thr Ala Phe Ala | Gln Val Asp Leu Ser Tyr | Thr Tyr His |  |      |
| 1610                    | 1615                    | 1620        |  |      |
| Leu Gly Glu Phe Ser Val | Thr Pro Ile Leu Ser Ala | Arg Tyr Asp |  |      |
| 1625                    | 1630                    | 1635        |  |      |
| Thr Asn Gln Gly Ser Gly | Lys Ile Asn Val Asn Gln | Tyr Asp Phe |  |      |
| 1640                    | 1645                    | 1650        |  |      |
| Ala Tyr Asn Val Glu Asn | Gln Gln Gln Tyr Asn Ala | Gly Leu Lys |  |      |
| 1655                    | 1660                    | 1665        |  |      |

Leu Lys Tyr His Asn Val Lys Leu Ser Leu Ile Gly Gly Leu Thr  
 1670 1675 1680

Lys Ala Lys Gln Ala Glu Lys Gln Lys Thr Ala Glu Leu Lys Leu  
 1685 1690 1695

Ser Phe Ser Phe  
 1700

<210> 6  
 <211> 1848  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 6

Met Leu Asn Lys Lys Phe Lys Leu Asn Phe Ile Ala Leu Thr Val Ala  
 1 5 10 15

Tyr Ala Leu Thr Pro Tyr Thr Glu Ala Ala Leu Val Arg Asp Asp Val  
 20 25 30

Asp Tyr Gln Ile Phe Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe Ser  
 35 40 45

Val Gly Ala Thr Asn Val Glu Val Arg Asp Lys Lys Asn Gln Ser Leu  
 50 55 60

Gly Ser Ala Leu Pro Asn Gly Ile Pro Met Ile Asp Phe Ser Val Val  
 65 70 75 80

Asp Val Asp Lys Arg Ile Ala Thr Leu Val Asn Pro Gln Tyr Val Val  
 85 90 95

Gly Val Lys His Val Ser Asn Gly Val Ser Glu Leu His Phe Gly Asn  
 100 105 110

Leu Asn Gly Asn Met Asn Asn Gly Asn Ala Lys Ser His Arg Asp Val  
 115 120 125

Ser Ser Glu Glu Asn Arg Tyr Tyr Thr Val Glu Lys Asn Asn Phe Pro  
 130 135 140

Thr Glu Asn Val Thr Ser Phe Thr Lys Glu Glu Gln Asp Ala Gln Lys  
145 150 155 160

Arg Arg Glu Asp Tyr Tyr Met Pro Arg Leu Asp Lys Phe Val Thr Glu  
165 170 175

Val Ala Pro Ile Glu Ala Ser Thr Ala Asn Asn Asn Lys Gly Glu Tyr  
180 185 190

Asn Asn Ser Asp Lys Tyr Pro Ala Phe Val Arg Leu Gly Ser Gly Thr  
195 200 205

Gln Phe Ile Tyr Lys Lys Gly Ser Arg Tyr Gln Leu Ile Leu Thr Glu  
210 215 220

Lys Asp Lys Gln Gly Asn Leu Leu Arg Asn Trp Asp Val Gly Gly Asp  
225 230 235 240

Asn Leu Glu Leu Val Gly Asn Ala Tyr Thr Tyr Gly Ile Ala Gly Thr  
245 250 255

Pro Tyr Lys Val Asn His Glu Asn Asn Gly Leu Ile Gly Phe Gly Asn  
260 265 270

Ser Lys Glu Glu His Ser Asp Pro Lys Gly Ile Leu Ser Gln Asp Pro  
275 280 285

Leu Thr Asn Tyr Ala Val Leu Gly Asp Ser Gly Ser Pro Leu Phe Val  
290 295 300

Tyr Asp Arg Glu Lys Gly Lys Trp Leu Phe Leu Gly Ser Tyr Asp Phe  
305 310 315 320

Trp Ala Gly Tyr Asn Lys Lys Ser Trp Gln Glu Trp Asn Ile Tyr Lys  
325 330 335

His Glu Phe Ala Glu Lys Ile Tyr Gln Gln Tyr Ser Ala Gly Ser Leu  
340 345 350

Ile Gly Ser Asn Thr Gln Tyr Thr Trp Gln Ala Thr Gly Ser Thr Ser  
355 360 365

Thr Ile Thr Gly Gly Gly Glu Pro Leu Ser Val Asp Leu Thr Asp Gly

370

375

380

Lys Asp Lys Pro Asn His Gly Lys Ser Ile Thr Leu Lys Gly Ser Gly  
 385 390 395 400

Thr Leu Thr Leu Asn Asn His Ile Asp Gln Gly Ala Gly Gly Leu Phe  
 405 410 415

Phe Glu Gly Asp Tyr Glu Val Lys Gly Thr Ser Asp Ser Thr Thr Trp  
 420 425 430

Lys Gly Ala Gly Val Ser Val Ala Asp Gly Lys Thr Val Thr Trp Lys  
 435 440 445

Val His Asn Pro Lys Tyr Asp Arg Leu Ala Lys Ile Gly Lys Gly Thr  
 450 455 460

Leu Val Val Glu Gly Lys Gly Lys Asn Glu Gly Leu Leu Lys Val Gly  
 465 470 475 480

Asp Gly Thr Val Ile Leu Lys Gln Lys Ala Asp Ala Asn Asn Lys Val  
 485 490 495

Gln Ala Phe Ser Gln Val Gly Ile Val Ser Gly Arg Ser Thr Leu Val  
 500 505 510

Leu Asn Asp Asp Lys Gln Val Asp Pro Asn Ser Ile Tyr Phe Gly Phe  
 515 520 525

Arg Gly Gly Arg Leu Asp Leu Asn Gly Asn Ser Leu Thr Phe Asp His  
 530 535 540

Ile Arg Asn Ile Asp Asp Gly Ala Arg Val Val Asn His Asn Met Thr  
 545 550 555 560

Asn Thr Ser Asn Ile Thr Ile Thr Gly Glu Ser Leu Ile Thr Asn Pro  
 565 570 575

Asn Thr Ile Thr Ser Tyr Asn Ile Glu Ala Gln Asp Asp Asp His Pro  
 580 585 590

Leu Arg Ile Arg Ser Ile Pro Tyr Arg Gln Leu Tyr Phe Asn Gln Asp  
 595 600 605

Asn Arg Ser Tyr Tyr Thr Leu Lys Lys Gly Ala Ser Thr Arg Ser Glu  
610 615 620

Leu Pro Gln Asn Ser Gly Glu Ser Asn Glu Asn Trp Leu Tyr Met Gly  
625 630 635 640

Arg Thr Ser Asp Ala Ala Lys Arg Asn Val Met Asn His Ile Asn Asn  
645 650 655

Glu Arg Met Asn Gly Phe Asn Gly Tyr Phe Gly Glu Glu Glu Thr Lys  
660 665 670

Ala Thr Gln Asn Gly Lys Leu Asn Val Thr Phe Asn Gly Lys Ser Asp  
675 680 685

Gln Asn Arg Phe Leu Leu Thr Gly Gly Thr Asn Leu Asn Gly Asp Leu  
690 695 700

Asn Val Glu Lys Gly Thr Leu Phe Leu Ser Gly Arg Pro Thr Pro His  
705 710 715 720

Ala Arg Asp Ile Ala Gly Ile Ser Ser Thr Lys Lys Asp Pro His Phe  
725 730 735

Thr Glu Asn Asn Glu Val Val Val Glu Asp Asp Trp Ile Asn Arg Asn  
740 745 750

Phe Lys Ala Thr Thr Met Asn Val Thr Gly Asn Ala Ser Leu Tyr Ser  
755 760 765

Gly Arg Asn Val Ala Asn Ile Thr Ser Asn Ile Thr Ala Ser Asn Asn  
770 775 780

Ala Gln Val His Ile Gly Tyr Lys Thr Gly Asp Thr Val Cys Val Arg  
785 790 795 800

Ser Asp Tyr Thr Gly Tyr Val Thr Cys His Asn Ser Asn Leu Ser Glu  
805 810 815

Lys Ala Leu Asn Ser Phe Asn Pro Thr Asn Leu Arg Gly Asn Val Asn  
820 825 830

Leu Thr Glu Asn Ala Ser Phe Thr Leu Gly Lys Ala Asn Leu Phe Gly  
835 840 845

Thr Ile Gln Ser Ile Gly Thr Ser Gln Val Asn Leu Lys Glu Asn Ser  
850 855 860

His Trp His Leu Thr Gly Asn Ser Asn Val Asn Gln Leu Asn Leu Thr  
865 870 875 880

Asn Gly His Ile His Leu Asn Ala Gln Asn Asp Ala Asn Lys Val Thr  
885 890 895

Thr Tyr Asn Thr Leu Thr Val Asn Ser Leu Ser Gly Asn Gly Ser Phe  
900 905 910

Tyr Tyr Trp Val Asp Phe Thr Asn Asn Lys Ser Asn Lys Val Val Val  
915 920 925

Asn Lys Ser Ala Thr Gly Asn Phe Thr Leu Gln Val Ala Asp Lys Thr  
930 935 940

Gly Glu Pro Asn His Asn Glu Leu Thr Leu Phe Asp Ala Ser Asn Ala  
945 950 955 960

Thr Arg Asn Asn Leu Glu Val Thr Leu Ala Asn Gly Ser Val Asp Arg  
965 970 975

Gly Ala Trp Lys Tyr Lys Leu Arg Asn Val Asn Gly Arg Tyr Asp Leu  
980 985 990

Tyr Asn Pro Glu Val Glu Lys Arg Asn Gln Thr Val Asp Thr Thr Asn  
995 1000 1005

Ile Thr Thr Pro Asn Asp Ile Gln Ala Asp Ala Pro Ser Ala Gln  
1010 1015 1020

Ser Asn Asn Glu Glu Ile Ala Arg Val Glu Thr Pro Val Pro Pro  
1025 1030 1035

Pro Ala Pro Ala Thr Glu Ser Ala Ile Ala Ser Glu Gln Pro Glu  
1040 1045 1050



|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|
| Thr  | Arg | Pro | Ala | Glu | Thr | Ala  | Gln | Pro | Ala | Met | Glu  | Glu | Thr | Asn |
| 1055 |     |     |     |     |     | 1060 |     |     |     |     | 1065 |     |     |     |
| Thr  | Ala | Asn | Ser | Thr | Glu | Thr  | Ala | Pro | Lys | Ser | Asp  | Thr | Ala | Thr |
| 1070 |     |     |     |     |     | 1075 |     |     |     |     | 1080 |     |     |     |
| Gln  | Thr | Glu | Asn | Pro | Asn | Ser  | Glu | Ser | Val | Pro | Ser  | Glu | Thr | Thr |
| 1085 |     |     |     |     |     | 1090 |     |     |     |     | 1095 |     |     |     |
| Glu  | Lys | Val | Ala | Glu | Asn | Pro  | Pro | Gln | Glu | Asn | Glu  | Thr | Val | Ala |
| 1100 |     |     |     |     |     | 1105 |     |     |     |     | 1110 |     |     |     |
| Lys  | Asn | Glu | Gln | Glu | Ala | Thr  | Glu | Pro | Thr | Pro | Gln  | Asn | Gly | Glu |
| 1115 |     |     |     |     |     | 1120 |     |     |     |     | 1125 |     |     |     |
| Val  | Ala | Lys | Glu | Asp | Gln | Pro  | Thr | Val | Glu | Ala | Asn  | Thr | Gln | Thr |
| 1130 |     |     |     |     |     | 1135 |     |     |     |     | 1140 |     |     |     |
| Asn  | Glu | Ala | Thr | Gln | Ser | Glu  | Gly | Lys | Thr | Glu | Glu  | Thr | Gln | Thr |
| 1145 |     |     |     |     |     | 1150 |     |     |     |     | 1155 |     |     |     |
| Ala  | Glu | Thr | Lys | Ser | Glu | Pro  | Thr | Glu | Ser | Val | Thr  | Val | Ser | Glu |
| 1160 |     |     |     |     |     | 1165 |     |     |     |     | 1170 |     |     |     |
| Asn  | Gln | Pro | Glu | Lys | Thr | Val  | Ser | Gln | Ser | Thr | Glu  | Asp | Lys | Val |
| 1175 |     |     |     |     |     | 1180 |     |     |     |     | 1185 |     |     |     |
| Val  | Val | Glu | Lys | Glu | Glu | Lys  | Ala | Lys | Val | Glu | Thr  | Glu | Glu | Thr |
| 1190 |     |     |     |     |     | 1195 |     |     |     |     | 1200 |     |     |     |
| Gln  | Lys | Ala | Pro | Gln | Val | Thr  | Ser | Lys | Glu | Pro | Pro  | Lys | Gln | Ala |
| 1205 |     |     |     |     |     | 1210 |     |     |     |     | 1215 |     |     |     |
| Glu  | Pro | Ala | Pro | Glu | Glu | Val  | Pro | Thr | Asp | Thr | Asn  | Ala | Glu | Glu |
| 1220 |     |     |     |     |     | 1225 |     |     |     |     | 1230 |     |     |     |
| Ala  | Gln | Ala | Leu | Gln | Gln | Thr  | Gln | Pro | Thr | Thr | Val  | Ala | Ala | Ala |
| 1235 |     |     |     |     |     | 1240 |     |     |     |     | 1245 |     |     |     |
| Glu  | Thr | Thr | Ser | Pro | Asn | Ser  | Lys | Pro | Ala | Glu | Glu  | Thr | Gln | Gln |
| 1250 |     |     |     |     |     | 1255 |     |     |     |     | 1260 |     |     |     |
| Pro  | Ser | Glu | Lys | Thr | Asn | Ala  | Glu | Pro | Val | Thr | Pro  | Val | Val | Ser |

|   |  |      |  |      |
|---|--|------|--|------|
| 1265  |  | 1270 |  | 1275 |
| Glu Asn Thr Ala Thr Gln Pro Thr Glu Thr Glu Glu Thr Ala Lys |  |      |  |      |
| 1280  |  | 1285 |  | 1290 |
| Val Glu Lys Glu Lys Thr Gln Glu Val Pro Gln Val Ala Ser Gln |  |      |  |      |
| 1295  |  | 1300 |  | 1305 |
| Glu Ser Pro Lys Gln Glu Gln Pro Ala Ala Lys Pro Gln Ala Gln |  |      |  |      |
| 1310  |  | 1315 |  | 1320 |
| Thr Lys Pro Gln Ala Glu Pro Ala Arg Glu Asn Val Leu Thr Thr |  |      |  |      |
| 1325  |  | 1330 |  | 1335 |
| Lys Asn Val Gly Glu Pro Gln Pro Gln Ala Gln Pro Gln Thr Gln |  |      |  |      |
| 1340  |  | 1345 |  | 1350 |
| Ser Thr Ala Val Pro Thr Thr Gly Glu Thr Ala Ala Asn Ser Lys |  |      |  |      |
| 1355  |  | 1360 |  | 1365 |
| Pro Ala Ala Lys Pro Gln Ala Gln Ala Lys Pro Gln Thr Glu Pro |  |      |  |      |
| 1370  |  | 1375 |  | 1380 |
| Ala Arg Glu Asn Val Ser Thr Val Asn Thr Lys Glu Pro Gln Ser |  |      |  |      |
| 1385  |  | 1390 |  | 1395 |
| Gln Thr Ser Ala Thr Val Ser Thr Glu Gln Pro Ala Lys Glu Thr |  |      |  |      |
| 1400  |  | 1405 |  | 1410 |
| Ser Ser Asn Val Glu Gln Pro Ala Pro Glu Asn Ser Ile Asn Thr |  |      |  |      |
| 1415  |  | 1420 |  | 1425 |
| Gly Ser Ala Thr Thr Met Thr Glu Thr Ala Glu Lys Ser Asp Lys |  |      |  |      |
| 1430  |  | 1435 |  | 1440 |
| Pro Gln Met Glu Thr Val Thr Glu Asn Asp Arg Gln Pro Glu Ala |  |      |  |      |
| 1445  |  | 1450 |  | 1455 |
| Asn Thr Val Ala Asp Asn Ser Val Ala Asn Asn Ser Glu Ser Ser |  |      |  |      |
| 1460  |  | 1465 |  | 1470 |
| Glu Ser Lys Ser Arg Arg Arg Arg Ser Val Ser Gln Pro Lys Glu |  |      |  |      |
| 1475  |  | 1480 |  | 1485 |

|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|
| Thr  | Ser | Ala | Glu | Glu | Thr | Thr  | Val | Ala | Ser | Thr | Gln  | Glu | Thr | Thr |
| 1490 |     |     |     |     |     | 1495 |     |     |     |     | 1500 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Val  | Asp | Asn | Ser | Val | Ser | Thr  | Pro | Lys | Pro | Arg | Ser  | Arg | Arg | Thr |
| 1505 |     |     |     |     |     | 1510 |     |     |     |     | 1515 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Arg  | Arg | Ser | Val | Gln | Thr | Asn  | Ser | Tyr | Glu | Pro | Val  | Glu | Leu | Pro |
| 1520 |     |     |     |     |     | 1525 |     |     |     |     | 1530 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Thr  | Glu | Asn | Ala | Glu | Asn | Ala  | Glu | Asn | Val | Gln | Ser  | Gly | Asn | Asn |
| 1535 |     |     |     |     |     | 1540 |     |     |     |     | 1545 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Val  | Ala | Asn | Ser | Gln | Pro | Ala  | Leu | Arg | Asn | Leu | Thr  | Ser | Lys | Asn |
| 1550 |     |     |     |     |     | 1555 |     |     |     |     | 1560 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Thr  | Asn | Ala | Val | Ile | Ser | Asn  | Ala | Met | Ala | Lys | Ala  | Gln | Phe | Val |
| 1565 |     |     |     |     |     | 1570 |     |     |     |     | 1575 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Ala  | Leu | Asn | Val | Gly | Lys | Ala  | Val | Ser | Gln | His | Ile  | Ser | Gln | Leu |
| 1580 |     |     |     |     |     | 1585 |     |     |     |     | 1590 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Glu  | Met | Asn | Asn | Glu | Gly | Gln  | Tyr | Asn | Val | Trp | Ile  | Ser | Asn | Thr |
| 1595 |     |     |     |     |     | 1600 |     |     |     |     | 1605 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Ser  | Met | Asn | Lys | Asn | Tyr | Ser  | Ser | Glu | Gln | Tyr | Arg  | Arg | Phe | Ser |
| 1610 |     |     |     |     |     | 1615 |     |     |     |     | 1620 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Ser  | Lys | Ser | Thr | Gln | Thr | Gln  | Leu | Gly | Trp | Asp | Gln  | Thr | Ile | Ser |
| 1625 |     |     |     |     |     | 1630 |     |     |     |     | 1635 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Asn  | Asn | Val | Gln | Leu | Gly | Gly  | Val | Phe | Thr | Tyr | Val  | Arg | Asn | Ser |
| 1640 |     |     |     |     |     | 1645 |     |     |     |     | 1650 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Asn  | Asn | Phe | Asp | Lys | Ala | Ser  | Ser | Lys | Asn | Thr | Leu  | Ala | Gln | Val |
| 1655 |     |     |     |     |     | 1660 |     |     |     |     | 1665 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Asn  | Phe | Tyr | Ser | Lys | Tyr | Tyr  | Ala | Asp | Asn | His | Trp  | Tyr | Leu | Gly |
| 1670 |     |     |     |     |     | 1675 |     |     |     |     | 1680 |     |     |     |
|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
| Ile  | Asp | Leu | Gly | Tyr | Gly | Lys  | Phe | Gln | Ser | Asn | Leu  | Gln | Thr | Asn |
| 1685 |     |     |     |     |     | 1690 |     |     |     |     | 1695 |     |     |     |

Asn Asn Ala Lys Phe Ala Arg His Thr Ala Gln Ile Gly Leu Thr  
 1700 1705 1710

Ala Gly Lys Ala Phe Asn Leu Gly Asn Phe Ala Val Lys Pro Thr  
 1715 1720 1725

Val Gly Val Arg Tyr Ser Tyr Leu Ser Asn Ala Asp Phe Ala Leu  
 1730 1735 1740

Ala Gln Asp Arg Ile Lys Val Asn Pro Ile Ser Val Lys Thr Ala  
 1745 1750 1755

Phe Ala Gln Val Asp Leu Ser Tyr Thr Tyr His Leu Gly Glu Phe  
 1760 1765 1770

Ser Ile Thr Pro Ile Leu Ser Ala Arg Tyr Asp Ala Asn Gln Gly  
 1775 1780 1785

Asn Gly Lys Ile Asn Val Ser Val Tyr Asp Phe Ala Tyr Asn Val  
 1790 1795 1800

Glu Asn Gln Gln Gln Tyr Asn Ala Gly Leu Lys Leu Lys Tyr His  
 1805 1810 1815

Asn Val Lys Leu Ser Leu Ile Gly Gly Leu Thr Lys Ala Lys Gln  
 1820 1825 1830

Ala Glu Lys Gln Lys Thr Ala Glu Val Lys Leu Ser Phe Ser Phe  
 1835 1840 1845

<210> 7

<211> 1395

<212> PRT

<213> Haemophilus influenzae

<400> 7

Met Lys Lys Thr Val Phe Arg Leu Asn Phe Leu Thr Ala Cys Ile Ser  
 1 5 10 15

Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr Phe Gly Ile  
 20 25 30

Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe Thr

35

40

45

Val Gly Ala Gln Asn Ile Lys Val Tyr Asn Lys Gln Gly Gln Leu Val  
50 55 60

Gly Thr Ser Met Thr Lys Ala Pro Met Ile Asp Phe Ser Val Val Ser  
65 70 75 80

Arg Asn Gly Val Ala Ala Leu Val Glu Asn Gln Tyr Ile Val Ser Val  
85 90 95

Ala His Asn Val Gly Tyr Thr Asp Val Asp Phe Gly Ala Glu Gly Asn  
100 105 110

Asn Pro Asp Gln His Arg Phe Thr Tyr Lys Ile Val Lys Arg Asn Asn  
115 120 125

Tyr Lys Lys Asp Asn Leu His Pro Tyr Glu Asp Asp Tyr His Asn Pro  
130 135 140

Arg Leu His Lys Phe Val Thr Glu Ala Ala Pro Ile Asp Met Thr Ser  
145 150 155 160

Asn Met Asn Gly Ser Thr Tyr Ser Asp Arg Thr Lys Tyr Pro Glu Arg  
165 170 175

Val Arg Ile Gly Ser Gly Arg Gln Phe Trp Arg Asn Asp Gln Asp Lys  
180 185 190

Gly Asp Gln Val Ala Gly Ala Tyr His Tyr Leu Thr Ala Gly Asn Thr  
195 200 205

His Asn Gln Arg Gly Ala Gly Asn Gly Tyr Ser Tyr Leu Gly Gly Asp  
210 215 220

Val Arg Lys Ala Gly Glu Tyr Gly Pro Leu Pro Ile Ala Gly Ser Lys  
225 230 235 240

Gly Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp Ala Glu Lys Gln Lys  
245 250 255

Trp Leu Ile Asn Gly Ile Leu Arg Glu Gly Asn Pro Phe Glu Gly Lys  
260 265 270

Glu Asn Gly Phe Gln Leu Val Arg Lys Ser Tyr Phe Asp Glu Ile Phe  
 275 280 285

Glu Arg Asp Leu His Thr Ser Leu Tyr Thr Arg Ala Gly Asn Gly Val  
 290 295 300

Tyr Thr Ile Ser Gly Asn Asp Asn Gly Gln Gly Ser Ile Thr Gln Lys  
 305 310 315 320

Ser Gly Ile Pro Ser Glu Ile Lys Ile Thr Leu Ala Asn Met Ser Leu  
 325 330 335

Pro Leu Lys Glu Lys Asp Lys Val His Asn Pro Arg Tyr Asp Gly Pro  
 340 345 350

Asn Ile Tyr Ser Pro Arg Leu Asn Asn Gly Glu Thr Leu Tyr Phe Met  
 355 360 365

Asp Gln Lys Gln Gly Ser Leu Ile Phe Ala Ser Asp Ile Asn Gln Gly  
 370 375 380

Ala Gly Gly Leu Tyr Phe Glu Gly Asn Phe Thr Val Ser Pro Asn Ser  
 385 390 395 400

Asn Gln Thr Trp Gln Gly Ala Gly Ile His Val Ser Glu Asn Ser Thr  
 405 410 415

Val Thr Trp Lys Val Asn Gly Val Glu His Asp Arg Leu Ser Lys Ile  
 420 425 430

Gly Lys Gly Thr Leu His Val Gln Ala Lys Gly Glu Asn Lys Gly Ser  
 435 440 445

Ile Ser Val Gly Asp Gly Lys Val Ile Leu Glu Gln Gln Ala Asp Asp  
 450 455 460

Gln Gly Asn Lys Gln Ala Phe Ser Glu Ile Gly Leu Val Ser Gly Arg  
 465 470 475 480

Gly Thr Val Gln Leu Asn Asp Asp Lys Gln Phe Asp Thr Asp Lys Phe  
 485 490 495

Tyr Phe Gly Phe Arg Gly Gly Arg Leu Asp Leu Asn Gly His Ser Leu  
 500 505 510

Thr Phe Lys Arg Ile Gln Asn Thr Asp Glu Gly Ala Met Ile Val Asn  
 515 520 525

His Asn Thr Thr Gln Ala Ala Asn Val Thr Ile Thr Gly Asn Glu Ser  
 530 535 540

Ile Val Leu Pro Asn Gly Asn Asn Ile Asn Lys Leu Asp Tyr Arg Lys  
 545 550 555 560

Glu Ile Ala Tyr Asn Gly Trp Phe Gly Glu Thr Asp Lys Asn Lys His  
 565 570 575

Asn Gly Arg Leu Asn Leu Ile Tyr Lys Pro Thr Thr Glu Asp Arg Thr  
 580 585 590

Leu Leu Leu Ser Gly Gly Thr Asn Leu Lys Gly Asp Ile Thr Gln Thr  
 595 600 605

Lys Gly Lys Leu Phe Phe Ser Gly Arg Pro Thr Pro His Ala Tyr Asn  
 610 615 620

His Leu Asn Lys Arg Trp Ser Glu Met Glu Gly Ile Pro Gln Gly Glu  
 625 630 635 640

Ile Val Trp Asp His Asp Trp Ile Asn Arg Thr Phe Lys Ala Glu Asn  
 645 650 655

Phe Gln Ile Lys Gly Gly Ser Ala Val Val Ser Arg Asn Val Ser Ser  
 660 665 670

Ile Glu Gly Asn Trp Thr Val Ser Asn Asn Ala Asn Ala Thr Phe Gly  
 675 680 685

Val Val Pro Asn Gln Gln Asn Thr Ile Cys Thr Arg Ser Asp Trp Thr  
 690 695 700

Gly Leu Thr Thr Cys Gln Lys Val Asp Leu Thr Asp Thr Lys Val Ile  
 705 710 715 720

Asn Ser Ile Pro Lys Thr Gln Ile Asn Gly Ser Ile Asn Leu Thr Asp  
725 730 735

Asn Ala Thr Ala Asn Val Lys Gly Leu Ala Lys Leu Asn Gly Asn Val  
740 745 750

Thr Leu Thr Asn His Ser Gln Phe Thr Leu Ser Asn Asn Ala Thr Gln  
755 760 765

Ile Gly Asn Ile Arg Leu Ser Asp Asn Ser Thr Ala Thr Val Asp Asn  
770 775 780

Ala Asn Leu Asn Gly Asn Val His Leu Thr Asp Ser Ala Gln Phe Ser  
785 790 795 800

Leu Lys Asn Ser His Phe Ser His Gln Ile Gln Gly Asp Lys Gly Thr  
805 810 815

Thr Val Thr Leu Glu Asn Ala Thr Trp Thr Met Pro Ser Asp Thr Thr  
820 825 830

Leu Gln Asn Leu Thr Leu Asn Asn Ser Thr Ile Thr Leu Asn Ser Ala  
835 840 845

Tyr Ser Ala Ser Ser Asn Asn Thr Pro Arg Arg Arg Arg Arg Ser Leu  
850 855 860

Glu Thr Glu Thr Thr Pro Thr Ser Ala Glu His Arg Phe Asn Thr Leu  
865 870 875 880

Thr Val Asn Gly Lys Leu Ser Gly Gln Gly Thr Phe Gln Phe Thr Ser  
885 890 895

Ser Leu Phe Gly Tyr Lys Ser Asp Lys Leu Lys Leu Ser Asn Asp Ala  
900 905 910

Glu Gly Asp Tyr Ile Leu Ser Val Arg Asn Thr Gly Lys Glu Pro Glu  
915 920 925

Thr Leu Glu Gln Leu Thr Leu Val Glu Ser Lys Asp Asn Gln Pro Leu  
930 935 940

Ser Asp Lys Leu Lys Phe Thr Leu Glu Asn Asp His Val Asp Ala Gly



|   |      |      |      |
|---|------|------|------|
| 945   | 950  | 955  | 960  |
| Ala Leu Arg Tyr Lys Leu Val Lys Asn Asp Gly Glu Phe Arg Leu His | 965  | 970  | 975  |
| Asn Pro Ile Lys Glu Gln Glu Leu His Asn Asp Leu Val Arg Ala Glu | 980  | 985  | 990  |
| Gln Ala Glu Arg Thr Leu Glu Ala Lys Gln Val Glu Pro Thr Ala Lys | 995  | 1000 | 1005 |
| Thr Gln Thr Gly Glu Pro Lys Val Arg Ser Arg Arg Ala Ala Arg     | 1010 | 1015 | 1020 |
| Ala Ala Phe Pro Asp Thr Leu Pro Asp Gln Ser Leu Leu Asn Ala     | 1025 | 1030 | 1035 |
| Leu Glu Ala Lys Gln Ala Glu Leu Thr Ala Glu Thr Gln Lys Ser     | 1040 | 1045 | 1050 |
| Lys Ala Lys Thr Lys Lys Val Arg Ser Lys Arg Ala Val Phe Ser     | 1055 | 1060 | 1065 |
| Asp Pro Leu Leu Asp Gln Ser Leu Phe Ala Leu Glu Ala Ala Leu     | 1070 | 1075 | 1080 |
| Glu Val Ile Asp Ala Pro Gln Gln Ser Glu Lys Asp Arg Leu Ala     | 1085 | 1090 | 1095 |
| Gln Glu Glu Ala Glu Lys Gln Arg Lys Gln Lys Asp Leu Ile Ser     | 1100 | 1105 | 1110 |
| Arg Tyr Ser Asn Ser Ala Leu Ser Glu Leu Ser Ala Thr Val Asn     | 1115 | 1120 | 1125 |
| Ser Met Leu Ser Val Gln Asp Glu Leu Asp Arg Leu Phe Val Asp     | 1130 | 1135 | 1140 |
| Gln Ala Gln Ser Ala Val Trp Thr Asn Ile Ala Gln Asp Lys Arg     | 1145 | 1150 | 1155 |
| Arg Tyr Asp Ser Asp Ala Phe Arg Ala Tyr Gln Gln Lys Thr Asn     | 1160 | 1165 | 1170 |

|         |                 |      |                     |             |             |
|---------|-----------------|------|---------------------|-------------|-------------|
| Leu Arg | Gln Ile Gly Val | Gln  | Lys Ala Leu Ala     | Asn         | Gly Arg Ile |
| 1175    |                 | 1180 |                     | 1185        |             |
| Gly Ala | Val Phe Ser His | Ser  | Arg Ser Asp Asn Thr | Phe Asp Glu |             |
| 1190    |                 | 1195 |                     | 1200        |             |
| Gln Val | Lys Asn His Ala | Thr  | Leu Thr Met Met     | Ser         | Gly Phe Ala |
| 1205    |                 | 1210 |                     | 1215        |             |
| Gln Tyr | Gln Trp Gly Asp | Leu  | Gln Phe Gly Val     | Asn         | Val Gly Thr |
| 1220    |                 | 1225 |                     | 1230        |             |
| Gly Ile | Ser Ala Ser Lys | Met  | Ala Glu Glu Gln     | Ser         | Arg Lys Ile |
| 1235    |                 | 1240 |                     | 1245        |             |
| His Arg | Lys Ala Ile Asn | Tyr  | Gly Val Asn Ala     | Ser         | Tyr Gln Phe |
| 1250    |                 | 1255 |                     | 1260        |             |
| Arg Leu | Gly Gln Leu Gly | Ile  | Gln Pro Tyr Phe     | Gly         | Val Asn Arg |
| 1265    |                 | 1270 |                     | 1275        |             |
| Tyr Phe | Ile Glu Arg Glu | Asn  | Tyr Gln Ser Glu     | Glu         | Val Arg Val |
| 1280    |                 | 1285 |                     | 1290        |             |
| Lys Thr | Pro Ser Leu Ala | Phe  | Asn Arg Tyr Asn     | Ala         | Gly Ile Arg |
| 1295    |                 | 1300 |                     | 1305        |             |
| Val Asp | Tyr Thr Phe Thr | Pro  | Thr Asp Asn Ile     | Ser         | Val Lys Pro |
| 1310    |                 | 1315 |                     | 1320        |             |
| Tyr Phe | Phe Val Asn Tyr | Val  | Asp Val Ser Asn     | Ala         | Asn Val Gln |
| 1325    |                 | 1330 |                     | 1335        |             |
| Thr Thr | Val Asn Leu Thr | Val  | Leu Gln Gln Pro     | Phe         | Gly Arg Tyr |
| 1340    |                 | 1345 |                     | 1350        |             |
| Trp Gln | Lys Glu Val Gly | Leu  | Lys Ala Glu Ile     | Leu         | His Phe Gln |
| 1355    |                 | 1360 |                     | 1365        |             |
| Ile Ser | Ala Phe Ile Ser | Lys  | Ser Gln Gly Ser     | Gln         | Leu Gly Lys |
| 1370    |                 | 1375 |                     | 1380        |             |

Gln Gln Asn Val Gly Val Lys Leu Gly Tyr Arg Trp  
 1385 1390 1395

<210> 8  
 <211> 4305  
 <212> DNA  
 <213> Haemophilus influenzae

<220>  
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 <223> "n" at position 1702 can be any base.

<220>  
 <221> CDS  
 <222> (1)..(4305)  
 <223>

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 Met Lys Lys Thr Val Phe Arg Leu Asn Phe Leu Thr Ala Cys Ile Ser  
 1 5 10 15  
 tta ggg ata gta tcg caa gcg tgg gca ggt cat act tat ttt ggg att 96  
 Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr Phe Gly Ile  
 20 25 30  
 gac tac caa tat tat cgt gat ttt gcc gag aat gaa ggc aag ttt gca 144  
 Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Glu Gly Lys Phe Ala  
 35 40 45  
 gtt ggg gct aaa aat att gat gtt tat aac aaa gaa ggg caa tta gtt 192  
 Val Gly Ala Lys Asn Ile Asp Val Tyr Asn Lys Glu Gly Gln Leu Val  
 50 55 60  
 ggc aca tca atg aca aaa gcc ccg atg att gat ttc tca gtc gtt tcc 240  
 Gly Thr Ser Met Thr Lys Ala Pro Met Ile Asp Phe Ser Val Val Ser  
 65 70 75 80  
 aga aat gga gtt gct gcc tta gta ggc gat cag tat att gtg agt gtg 288  
 Arg Asn Gly Val Ala Ala Leu Val Gly Asp Gln Tyr Ile Val Ser Val  
 85 90 95  
 gca cat aat gta ggc tat acc aat gtg gat ttt ggt gct gaa gga caa 336  
 Ala His Asn Val Gly Tyr Thr Asn Val Asp Phe Gly Ala Glu Gly Gln  
 100 105 110  
 aat cct gat caa cat cgt ttt act tat aaa att gtg aaa cgg aat aat 384  
 Asn Pro Asp Gln His Arg Phe Thr Tyr Lys Ile Val Lys Arg Asn Asn  
 115 120 125  
 tat aat cac gat gcg aag cac cgc tat cta gat gac tac cat aat cca 432  
 Tyr Asn His Asp Ala Lys His Arg Tyr Leu Asp Asp Tyr His Asn Pro

| 130   | 135 | 140 |      |
|---|-----|-----|------|
| cgt tta cat aaa ttt gta acg gat gcg gca cca att gat atg act tca<br>Arg Leu His Lys Phe Val Thr Asp Ala Ala Pro Ile Asp Met Thr Ser<br>145 150 155 160 |     |     | 480  |
| cat atg gat ggc aat aag tat gca aat aag gaa aaa tat cct gaa cga<br>His Met Asp Gly Asn Lys Tyr Ala Asn Lys Glu Lys Tyr Pro Glu Arg<br>165 170 175     |     |     | 528  |
| gta cgc gtc gga tct gga gat cag tat tgg gat gac gat caa aac aac<br>Val Arg Val Gly Ser Gly Asp Gln Tyr Trp Asp Asp Asp Gln Asn Asn<br>180 185 190     |     |     | 576  |
| aga act tat tta tct gac gga tat aat tat tta aca ggt ggg aat aca<br>Arg Thr Tyr Leu Ser Asp Gly Tyr Asn Tyr Leu Thr Gly Gly Asn Thr<br>195 200 205     |     |     | 624  |
| tat aat caa agc ggt aga ggt gat gga tat tca tat gtg aga ggt gat<br>Tyr Asn Gln Ser Gly Arg Gly Asp Gly Tyr Ser Tyr Val Arg Gly Asp<br>210 215 220     |     |     | 672  |
| att cgc aaa gtt ggc gat tat ggt cca tta ccg att gca agt tca ttc<br>Ile Arg Lys Val Gly Asp Tyr Gly Pro Leu Pro Ile Ala Ser Ser Phe<br>225 230 235 240 |     |     | 720  |
| ggg gac agt gga tct cca atg ttt att tat gat gct gaa aca caa aaa<br>Gly Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp Ala Glu Thr Gln Lys<br>245 250 255     |     |     | 768  |
| tgg cta att aat gga gta ttg cgg gag ggg caa cct tat aca ggc gaa<br>Trp Leu Ile Asn Gly Val Leu Arg Glu Gly Gln Pro Tyr Thr Gly Glu<br>260 265 270     |     |     | 816  |
| ttc gat gga ttt caa tta gcc cgt aaa tct ttc ctt gat gaa att ata<br>Phe Asp Gly Phe Gln Leu Ala Arg Lys Ser Phe Leu Asp Glu Ile Ile<br>275 280 285     |     |     | 864  |
| cgc aaa gat caa cca aat ggt ttt tta acc cct aag ggg aat ggc gtt<br>Arg Lys Asp Gln Pro Asn Gly Phe Leu Thr Pro Lys Gly Asn Gly Val<br>290 295 300     |     |     | 912  |
| tat acc att tct aaa agt gac gat ggg ata gga gtt gtt act tcg aaa<br>Tyr Thr Ile Ser Lys Ser Asp Asp Gly Ile Gly Val Val Thr Ser Lys<br>305 310 315 320 |     |     | 960  |
| att gga aaa cct cgt gaa ata cct tta gcg aac aac aaa tta aaa ata<br>Ile Gly Lys Pro Arg Glu Ile Pro Leu Ala Asn Asn Lys Leu Lys Ile<br>325 330 335     |     |     | 1008 |
| gaa gat aaa gat act gtc tat aat aac aga tat aat ggt cct aat att<br>Glu Asp Lys Asp Thr Val Tyr Asn Asn Arg Tyr Asn Gly Pro Asn Ile<br>340 345 350     |     |     | 1056 |
| tat tct cct caa tta aac aat ggc aag aat att tat ttt gga gat gaa<br>Tyr Ser Pro Gln Leu Asn Asn Gly Lys Asn Ile Tyr Phe Gly Asp Glu<br>355 360 365     |     |     | 1104 |

|   |      |
|---|------|
| gaa tta gga tcc ata act tta acg act gat atc gat caa ggt gca ggc<br>Glu Leu Gly Ser Ile Thr Leu Thr Thr Asp Ile Asp Gln Gly Ala Gly<br>370 375 380     | 1152 |
| ggg ttg tat ttt gag ggg gat ttt ata gtt tcg cct acc aaa aat gaa<br>Gly Leu Tyr Phe Glu Gly Asp Phe Ile Val Ser Pro Thr Lys Asn Glu<br>385 390 395 400 | 1200 |
| acg tgg aaa ggt gcg ggc att cat gtc agt gaa att agt acc gtt act<br>Thr Trp Lys Gly Ala Gly Ile His Val Ser Glu Ile Ser Thr Val Thr<br>405 410 415     | 1248 |
| tgg aaa gta aac ggc gtg gaa aat gat cga ctt tct aaa atc ggt aaa<br>Trp Lys Val Asn Gly Val Glu Asn Asp Arg Leu Ser Lys Ile Gly Lys<br>420 425 430     | 1296 |
| gga aca tta cac gtt aaa gcc aaa ggg gaa aat aaa ggt tcg atc agc<br>Gly Thr Leu His Val Lys Ala Lys Gly Glu Asn Lys Gly Ser Ile Ser<br>435 440 445     | 1344 |
| gta ggc gat ggt aaa gtc att ttg gag cag cag gca gac gat caa ggc<br>Val Gly Asp Gly Lys Val Ile Leu Glu Gln Gln Ala Asp Asp Gln Gly<br>450 455 460     | 1392 |
| aac aaa caa gcc ttt agt gaa att ggc ttg gtt agc ggc aga ggg act<br>Asn Lys Gln Ala Phe Ser Glu Ile Gly Leu Val Ser Gly Arg Gly Thr<br>465 470 475 480 | 1440 |
| gtt caa tta aac gat gat aaa caa ttt gat acc gat aaa ttt tat ttc<br>Val Gln Leu Asn Asp Asp Lys Gln Phe Asp Thr Asp Lys Phe Tyr Phe<br>485 490 495     | 1488 |
| ggc ttt cgt ggt ggt cgc tta gat ctt aac gga cat tca tta acc ttt<br>Gly Phe Arg Gly Gly Arg Leu Asp Leu Asn Gly His Ser Leu Thr Phe<br>500 505 510     | 1536 |
| aaa cgt atc caa aat acg gac gag ggg gcg atg att gtg aac cat aat<br>Lys Arg Ile Gln Asn Thr Asp Glu Gly Ala Met Ile Val Asn His Asn<br>515 520 525     | 1584 |
| aca act caa gtc gct aat att act att act ggg aac gaa agt att act<br>Thr Thr Gln Val Ala Asn Ile Thr Ile Thr Gly Asn Glu Ser Ile Thr<br>530 535 540     | 1632 |
| gct cca tct aat aaa aat aat att aat aaa ctt gat tac agc aaa gaa<br>Ala Pro Ser Asn Lys Asn Asn Ile Asn Lys Leu Asp Tyr Ser Lys Glu<br>545 550 555 560 | 1680 |
| att gcc tac aac ggc tgg ttt ngc gaa aca gat aaa aat aaa cat aat<br>Ile Ala Tyr Asn Gly Trp Phe Xaa Glu Thr Asp Lys Asn Lys His Asn<br>565 570 575     | 1728 |
| gga cga tta aac ctt att tat aaa cca acc aca gaa gat cgt act ttg<br>Gly Arg Leu Asn Leu Ile Tyr Lys Pro Thr Thr Glu Asp Arg Thr Leu<br>580 585 590     | 1776 |

|   |      |
|---|------|
| cta ctt tca ggc ggc aca aac tta aaa ggc gat att act caa aca aaa<br>Leu Leu Ser Gly Gly Thr Asn Leu Lys Gly Asp Ile Thr Gln Thr Lys<br>595 600 605     | 1824 |
| ggc aaa cta ttt ttc agc ggc aga ccg aca ccc cac gcc tac aat cat<br>Gly Lys Leu Phe Phe Ser Gly Arg Pro Thr Pro His Ala Tyr Asn His<br>610 615 620     | 1872 |
| tta gac aaa cgt tgg tca gaa atg gaa ggc atc cca caa ggc gaa att<br>Leu Asp Lys Arg Trp Ser Glu Met Glu Gly Ile Pro Gln Gly Glu Ile<br>625 630 635 640 | 1920 |
| gtg tgg gat tac gat tgg att aac cgc aca ttt aaa gct gaa aac ttc<br>Val Trp Asp Tyr Asp Trp Ile Asn Arg Thr Phe Lys Ala Glu Asn Phe<br>645 650 655     | 1968 |
| caa att aaa ggc gga agt gcg gtg gtt tct cgc aat gtt tct tca att<br>Gln Ile Lys Gly Gly Ser Ala Val Val Ser Arg Asn Val Ser Ser Ile<br>660 665 670     | 2016 |
| gag gga aat tgg aca gtc agc aat aat gca aat gcc aca ttt ggt gtt<br>Glu Gly Asn Trp Thr Val Ser Asn Asn Ala Asn Ala Thr Phe Gly Val<br>675 680 685     | 2064 |
| gtg cca aat cag caa aat acc att tgc acg cgt tca gat tgg aca gga<br>Val Pro Asn Gln Gln Asn Thr Ile Cys Thr Arg Ser Asp Trp Thr Gly<br>690 695 700     | 2112 |
| tta acg act tgt aaa aca gtt aat tta acc gat aaa aaa gtt att gat<br>Leu Thr Thr Cys Lys Thr Val Asn Leu Thr Asp Lys Lys Val Ile Asp<br>705 710 715 720 | 2160 |
| tcc ata ccg aca aca caa att aat ggt tct att aat tta act gat aat<br>Ser Ile Pro Thr Thr Gln Ile Asn Gly Ser Ile Asn Leu Thr Asp Asn<br>725 730 735     | 2208 |
| gca aca gtg aat att aat ggt tta gca aaa ctt aat ggt aat gtc act<br>Ala Thr Val Asn Ile Asn Gly Leu Ala Lys Leu Asn Gly Asn Val Thr<br>740 745 750     | 2256 |
| tta ata aat cat agc caa ttt aca ttg agc aac aat gcc acc caa ata<br>Leu Ile Asn His Ser Gln Phe Thr Leu Ser Asn Asn Ala Thr Gln Ile<br>755 760 765     | 2304 |
| ggc aat atc aaa ctt tca aat cac gca aat gca agg gta aat aat gcc<br>Gly Asn Ile Lys Leu Ser Asn His Ala Asn Ala Arg Val Asn Asn Ala<br>770 775 780     | 2352 |
| act tta atg ggc gat gtg aat tta gcg gat act agc cgt ttt aca tta<br>Thr Leu Met Gly Asp Val Asn Leu Ala Asp Thr Ser Arg Phe Thr Leu<br>785 790 795 800 | 2400 |
| agc aat caa gca aca cag att ggc aca atc agt ctt cat cag caa gct<br>Ser Asn Gln Ala Thr Gln Ile Gly Thr Ile Ser Leu His Gln Gln Ala<br>805 810 815     | 2448 |
| caa gca aca gtg gat aat gca aac ttg aac ggt aat gtg cat tta acg   | 2496 |

|     |      |     |     |     |     |      |     |     |     |     |      |     |     |      |     |      |  |
|-----|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|------|-----|------|--|
| Gln | Ala  | Thr | Val | Asp | Asn | Ala  | Asn | Leu | Asn | Gly | Asn  | Val | His | Leu  | Thr |      |  |
|     |      |     | 820 |     |     |      |     | 825 |     |     |      |     | 830 |      |     |      |  |
| gat | tct  | gcc | aga | ttt | tct | tta  | aaa | aac | agt | cat | ttt  | tcg | cac | caa  | att | 2544 |  |
| Asp | Ser  | Ala | Arg | Phe | Ser | Leu  | Lys | Asn | Ser | His | Phe  | Ser | His | Gln  | Ile |      |  |
|     |      | 835 |     |     |     |      | 840 |     |     |     |      | 845 |     |      |     |      |  |
| cag | ggc  | gac | aaa | gac | aca | aca  | gtg | acg | ttg | gaa | aat  | gcg | act | tggt | aca | 2592 |  |
| Gln | Gly  | Asp | Lys | Asp | Thr | Thr  | Val | Thr | Leu | Glu | Asn  | Ala | Thr | Trp  | Thr |      |  |
|     | 850  |     |     |     |     | 855  |     |     |     |     | 860  |     |     |      |     |      |  |
| atg | cct  | agc | gat | act | aca | ttg  | cag | aat | tta | acg | cta  | aat | aat | agt  | act | 2640 |  |
| Met | Pro  | Ser | Asp | Thr | Thr | Leu  | Gln | Asn | Leu | Thr | Leu  | Asn | Asn | Ser  | Thr |      |  |
| 865 |      |     |     |     | 870 |      |     |     |     | 875 |      |     |     |      | 880 |      |  |
| gtt | acg  | tta | aat | tca | gct | tat  | tca | gct | agc | tca | aat  | aat | gcg | cca  | cgt | 2688 |  |
| Val | Thr  | Leu | Asn | Ser | Ala | Tyr  | Ser | Ala | Ser | Ser | Asn  | Asn | Ala | Pro  | Arg |      |  |
|     |      |     |     | 885 |     |      |     |     | 890 |     |      |     |     | 895  |     |      |  |
| cgc | cgc  | cgt | tca | tta | gag | acg  | gaa | aca | acg | cca | aca  | tcg | gca | gaa  | cat | 2736 |  |
| Arg | Arg  | Arg | Ser | Leu | Glu | Thr  | Glu | Thr | Thr | Pro | Thr  | Ser | Ala | Glu  | His |      |  |
|     |      |     | 900 |     |     |      |     | 905 |     |     |      |     | 910 |      |     |      |  |
| cgt | ttc  | aac | aca | ttg | aca | gta  | aat | ggg | aaa | ttg | agc  | ggg | caa | ggc  | aca | 2784 |  |
| Arg | Phe  | Asn | Thr | Leu | Thr | Val  | Asn | Gly | Lys | Leu | Ser  | Gly | Gln | Gly  | Thr |      |  |
|     |      | 915 |     |     |     |      | 920 |     |     |     |      | 925 |     |      |     |      |  |
| ttc | caa  | ttt | act | cca | tct | tta  | ttt | ggc | tat | gaa | agc  | gat | aaa | tta  | aaa | 2832 |  |
| Phe | Gln  | Phe | Thr | Pro | Ser | Leu  | Phe | Gly | Tyr | Glu | Ser  | Asp | Lys | Leu  | Lys |      |  |
|     | 930  |     |     |     |     | 935  |     |     |     |     | 940  |     |     |      |     |      |  |
| tta | tcc  | aat | gac | gct | gag | ggc  | gat | tac | aca | tta | tct  | gtt | cgc | aac  | aca | 2880 |  |
| Leu | Ser  | Asn | Asp | Ala | Glu | Gly  | Asp | Tyr | Thr | Leu | Ser  | Val | Arg | Asn  | Thr |      |  |
| 945 |      |     |     |     | 950 |      |     |     |     | 955 |      |     |     |      | 960 |      |  |
| ggc | aaa  | gaa | ccc | gtg | acc | ctt  | gag | caa | tta | act | ttg  | gtt | gaa | agc  | aaa | 2928 |  |
| Gly | Lys  | Glu | Pro | Val | Thr | Leu  | Glu | Gln | Leu | Thr | Leu  | Val | Glu | Ser  | Lys |      |  |
|     |      |     | 965 |     |     |      |     | 970 |     |     |      |     |     | 975  |     |      |  |
| gat | aat  | aaa | ccg | tta | tca | gac  | aaa | ctc | aaa | ttt | act  | tta | gaa | aat  | gac | 2976 |  |
| Asp | Asn  | Lys | Pro | Leu | Ser | Asp  | Lys | Leu | Lys | Phe | Thr  | Leu | Glu | Asn  | Asp |      |  |
|     |      | 980 |     |     |     |      |     | 985 |     |     |      |     | 990 |      |     |      |  |
| cac | gtt  | gat | gca | ggg | gca | tta  | cgt | tat | aaa | tta | gtg  | aag | aat | aag  | ggc | 3024 |  |
| His | Val  | Asp | Ala | Gly | Ala | Leu  | Arg | Tyr | Lys | Leu | Val  | Lys | Asn | Lys  | Gly |      |  |
|     |      | 995 |     |     |     | 1000 |     |     |     |     | 1005 |     |     |      |     |      |  |
| gaa | ttc  | cgc | ttg | cat | aac | cca  | ata | aaa | gag | cag | gaa  | ttg | cgc | tct  |     | 3069 |  |
| Glu | Phe  | Arg | Leu | His | Asn | Pro  | Ile | Lys | Glu | Gln | Glu  | Leu | Arg | Ser  |     |      |  |
|     | 1010 |     |     |     |     | 1015 |     |     |     |     | 1020 |     |     |      |     |      |  |
| gat | tta  | gta | aga | gca | gag | caa  | gca | gaa | cga | aca | tta  | gaa | gcc | aaa  |     | 3114 |  |
| Asp | Leu  | Val | Arg | Ala | Glu | Gln  | Ala | Glu | Arg | Thr | Leu  | Glu | Ala | Lys  |     |      |  |
|     | 1025 |     |     |     |     | 1030 |     |     |     |     | 1035 |     |     |      |     |      |  |
| caa | gtt  | gaa | cag | act | gct | gaa  | aca | caa | aca | agt | aat  | gca | aga | gtg  |     | 3159 |  |
| Gln | Val  | Glu | Gln | Thr | Ala | Glu  | Thr | Gln | Thr | Ser | Asn  | Ala | Arg | Val  |     |      |  |

|   |      |      |      |
|---|------|------|------|
| 1040  | 1045 | 1050 |      |
| cgg tca aga aga gcg gtg ttg tct gat acc ccg tct gct caa agc |      |      | 3204 |
| Arg Ser Arg Arg Ala Val Leu Ser Asp Thr Pro Ser Ala Gln Ser |      |      |      |
| 1055  | 1060 | 1065 |      |
| ctg tta aac gca tta gaa gtc aaa caa gct gaa ccg aat gct aaa |      |      | 3249 |
| Leu Leu Asn Ala Leu Glu Val Lys Gln Ala Glu Pro Asn Ala Lys |      |      |      |
| 1070  | 1075 | 1080 |      |
| aca caa aaa agt aag gca aaa aca aaa aaa gcg ccg tca aaa aga |      |      | 3294 |
| Thr Gln Lys Ser Lys Ala Lys Thr Lys Lys Ala Arg Ser Lys Arg |      |      |      |
| 1085  | 1090 | 1095 |      |
| gca ttg aga gaa gcg ttt tct gat acc ccg cct gat cta agc cag |      |      | 3339 |
| Ala Leu Arg Glu Ala Phe Ser Asp Thr Pro Pro Asp Leu Ser Gln |      |      |      |
| 1100  | 1105 | 1110 |      |
| tta aac gta tta gaa gcc gca ctt aag gtt att aat gcc caa ccg |      |      | 3384 |
| Leu Asn Val Leu Glu Ala Ala Leu Lys Val Ile Asn Ala Gln Pro |      |      |      |
| 1115  | 1120 | 1125 |      |
| caa aca gaa aaa gaa cgt caa gct caa gag gaa gaa gcg aaa aga |      |      | 3429 |
| Gln Thr Glu Lys Glu Arg Gln Ala Gln Glu Glu Glu Ala Lys Arg |      |      |      |
| 1130  | 1135 | 1140 |      |
| caa cgc aaa caa aaa gac ttg atc agc cgt tac tca aat agt gcg |      |      | 3474 |
| Gln Arg Lys Gln Lys Asp Leu Ile Ser Arg Tyr Ser Asn Ser Ala |      |      |      |
| 1145  | 1150 | 1155 |      |
| tta tcg gag ttg tct gca aca gta aat agt atg ctt tcc gtt caa |      |      | 3519 |
| Leu Ser Glu Leu Ser Ala Thr Val Asn Ser Met Leu Ser Val Gln |      |      |      |
| 1160  | 1165 | 1170 |      |
| gat gaa ttg gat cgt ctt ttt gta gat caa gca caa tct gcc ctg |      |      | 3564 |
| Asp Glu Leu Asp Arg Leu Phe Val Asp Gln Ala Gln Ser Ala Leu |      |      |      |
| 1175  | 1180 | 1185 |      |
| tgg aca aat atc gca cag gat aaa aga cgc tat gat tct gat gcg |      |      | 3609 |
| Trp Thr Asn Ile Ala Gln Asp Lys Arg Arg Tyr Asp Ser Asp Ala |      |      |      |
| 1190  | 1195 | 1200 |      |
| ttc cgt gct tat cag cag aaa acg aac ttg cgt caa att ggg gtg |      |      | 3654 |
| Phe Arg Ala Tyr Gln Gln Lys Thr Asn Leu Arg Gln Ile Gly Val |      |      |      |
| 1205  | 1210 | 1215 |      |
| caa aaa gcc tta gat aat gga cga att ggg gcg gtt ttc tcg cat |      |      | 3699 |
| Gln Lys Ala Leu Asp Asn Gly Arg Ile Gly Ala Val Phe Ser His |      |      |      |
| 1220  | 1225 | 1230 |      |
| agc cgt tca gat aat acc ttt gac gaa cag gtt aaa aat cac gcg |      |      | 3744 |
| Ser Arg Ser Asp Asn Thr Phe Asp Glu Gln Val Lys Asn His Ala |      |      |      |
| 1235  | 1240 | 1245 |      |
| aca tta acg atg atg tcg ggt ttt gcc caa tat caa tgg ggc gat |      |      | 3789 |
| Thr Leu Thr Met Met Ser Gly Phe Ala Gln Tyr Gln Trp Gly Asp |      |      |      |
| 1250  | 1255 | 1260 |      |



|   |      |
|---|------|
| tta caa ttt ggt gta aac gtg ggc gcg gga att agt gcg agt aaa | 3834 |
| Leu Gln Phe Gly Val Asn Val Gly Ala Gly Ile Ser Ala Ser Lys |      |
| 1265 1270 1275  |      |
| atg gct gaa gaa caa agc cga aaa att cat cga aaa gcg ata aat | 3879 |
| Met Ala Glu Glu Gln Ser Arg Lys Ile His Arg Lys Ala Ile Asn |      |
| 1280 1285 1290  |      |
| tat ggt gtg aat gca agt tat cag ttc cgt tta ggg caa ttg ggt | 3924 |
| Tyr Gly Val Asn Ala Ser Tyr Gln Phe Arg Leu Gly Gln Leu Gly |      |
| 1295 1300 1305  |      |
| att cag cct tat ttg ggt gtt aat cga tat ttt att gaa cgt gaa | 3969 |
| Ile Gln Pro Tyr Leu Gly Val Asn Arg Tyr Phe Ile Glu Arg Glu |      |
| 1310 1315 1320  |      |
| aat tat caa tct gaa gaa gtg aaa gtg caa aca ccg agc ctt gca | 4014 |
| Asn Tyr Gln Ser Glu Glu Val Lys Val Gln Thr Pro Ser Leu Ala |      |
| 1325 1330 1335  |      |
| ttt aat cgc tat aat gct ggc att cga gtt gat tat aca ttt acc | 4059 |
| Phe Asn Arg Tyr Asn Ala Gly Ile Arg Val Asp Tyr Thr Phe Thr |      |
| 1340 1345 1350  |      |
| ccg aca gat aat atc agc gtt aag cct tat ttc ttt gtc aat tat | 4104 |
| Pro Thr Asp Asn Ile Ser Val Lys Pro Tyr Phe Phe Val Asn Tyr |      |
| 1355 1360 1365  |      |
| gtt gat gtt tca aac gct aac gta caa acc act gta aat agc acg | 4149 |
| Val Asp Val Ser Asn Ala Asn Val Gln Thr Thr Val Asn Ser Thr |      |
| 1370 1375 1380  |      |
| atg ttg caa caa tca ttt ggg cgt tat tgg caa aaa gaa gtg gga | 4194 |
| Met Leu Gln Gln Ser Phe Gly Arg Tyr Trp Gln Lys Glu Val Gly |      |
| 1385 1390 1395  |      |
| tta aag gca gaa att tta cat ttc caa ctt tcc gct ttt atc tca | 4239 |
| Leu Lys Ala Glu Ile Leu His Phe Gln Leu Ser Ala Phe Ile Ser |      |
| 1400 1405 1410  |      |
| aaa tct caa ggt tca caa ctc ggt aaa cag caa aat gtg ggc gtg | 4284 |
| Lys Ser Gln Gly Ser Gln Leu Gly Lys Gln Gln Asn Val Gly Val |      |
| 1415 1420 1425  |      |
| aaa ttg ggc tat cgt tgg taa                                 | 4305 |
| Lys Leu Gly Tyr Arg Trp                                     |      |
| 1430  |      |

<210> 9  
 <211> 1434  
 <212> PRT  
 <213> Haemophilus influenzae

<220>  
 <221> misc\_feature

<222> (568)..(568)  
 <223> The 'Xaa' at location 568 stands for Ser, Gly, Arg, or Cys.

<220>  
 <221> misc\_feature  
 <222> (1702)..(1702)  
 <223> "n" at position 1702 can be any base.

<400> 9

Met Lys Lys Thr Val Phe Arg Leu Asn Phe Leu Thr Ala Cys Ile Ser  
 1 5 10 15

Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr Phe Gly Ile  
 20 25 30

Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Glu Gly Lys Phe Ala  
 35 40 45

Val Gly Ala Lys Asn Ile Asp Val Tyr Asn Lys Glu Gly Gln Leu Val  
 50 55 60

Gly Thr Ser Met Thr Lys Ala Pro Met Ile Asp Phe Ser Val Val Ser  
 65 70 75 80

Arg Asn Gly Val Ala Ala Leu Val Gly Asp Gln Tyr Ile Val Ser Val  
 85 90 95

Ala His Asn Val Gly Tyr Thr Asn Val Asp Phe Gly Ala Glu Gly Gln  
 100 105 110

Asn Pro Asp Gln His Arg Phe Thr Tyr Lys Ile Val Lys Arg Asn Asn  
 115 120 125

Tyr Asn His Asp Ala Lys His Arg Tyr Leu Asp Asp Tyr His Asn Pro  
 130 135 140

Arg Leu His Lys Phe Val Thr Asp Ala Ala Pro Ile Asp Met Thr Ser  
 145 150 155 160

His Met Asp Gly Asn Lys Tyr Ala Asn Lys Glu Lys Tyr Pro Glu Arg  
 165 170 175

Val Arg Val Gly Ser Gly Asp Gln Tyr Trp Asp Asp Asp Gln Asn Asn  
 180 185 190

Arg Thr Tyr Leu Ser Asp Gly Tyr Asn Tyr Leu Thr Gly Gly Asn Thr  
 195 200 205

Tyr Asn Gln Ser Gly Arg Gly Asp Gly Tyr Ser Tyr Val Arg Gly Asp  
 210 215 220

Ile Arg Lys Val Gly Asp Tyr Gly Pro Leu Pro Ile Ala Ser Ser Phe  
 225 230 235 240

Gly Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp Ala Glu Thr Gln Lys  
 245 250 255

Trp Leu Ile Asn Gly Val Leu Arg Glu Gly Gln Pro Tyr Thr Gly Glu  
 260 265 270

Phe Asp Gly Phe Gln Leu Ala Arg Lys Ser Phe Leu Asp Glu Ile Ile  
 275 280 285

Arg Lys Asp Gln Pro Asn Gly Phe Leu Thr Pro Lys Gly Asn Gly Val  
 290 295 300

Tyr Thr Ile Ser Lys Ser Asp Asp Gly Ile Gly Val Val Thr Ser Lys  
 305 310 315 320

Ile Gly Lys Pro Arg Glu Ile Pro Leu Ala Asn Asn Lys Leu Lys Ile  
 325 330 335

Glu Asp Lys Asp Thr Val Tyr Asn Asn Arg Tyr Asn Gly Pro Asn Ile  
 340 345 350

Tyr Ser Pro Gln Leu Asn Asn Gly Lys Asn Ile Tyr Phe Gly Asp Glu  
 355 360 365

Glu Leu Gly Ser Ile Thr Leu Thr Thr Asp Ile Asp Gln Gly Ala Gly  
 370 375 380

Gly Leu Tyr Phe Glu Gly Asp Phe Ile Val Ser Pro Thr Lys Asn Glu  
 385 390 395 400

Thr Trp Lys Gly Ala Gly Ile His Val Ser Glu Ile Ser Thr Val Thr  
 405 410 415

Trp Lys Val Asn Gly Val Glu Asn Asp Arg Leu Ser Lys Ile Gly Lys  
420 425 430

Gly Thr Leu His Val Lys Ala Lys Gly Glu Asn Lys Gly Ser Ile Ser  
435 440 445

Val Gly Asp Gly Lys Val Ile Leu Glu Gln Gln Ala Asp Asp Gln Gly  
450 455 460

Asn Lys Gln Ala Phe Ser Glu Ile Gly Leu Val Ser Gly Arg Gly Thr  
465 470 475 480

Val Gln Leu Asn Asp Asp Lys Gln Phe Asp Thr Asp Lys Phe Tyr Phe  
485 490 495

Gly Phe Arg Gly Gly Arg Leu Asp Leu Asn Gly His Ser Leu Thr Phe  
500 505 510

Lys Arg Ile Gln Asn Thr Asp Glu Gly Ala Met Ile Val Asn His Asn  
515 520 525

Thr Thr Gln Val Ala Asn Ile Thr Ile Thr Gly Asn Glu Ser Ile Thr  
530 535 540

Ala Pro Ser Asn Lys Asn Asn Ile Asn Lys Leu Asp Tyr Ser Lys Glu  
545 550 555 560

Ile Ala Tyr Asn Gly Trp Phe Xaa Glu Thr Asp Lys Asn Lys His Asn  
565 570 575

Gly Arg Leu Asn Leu Ile Tyr Lys Pro Thr Thr Glu Asp Arg Thr Leu  
580 585 590

Leu Leu Ser Gly Gly Thr Asn Leu Lys Gly Asp Ile Thr Gln Thr Lys  
595 600 605

Gly Lys Leu Phe Phe Ser Gly Arg Pro Thr Pro His Ala Tyr Asn His  
610 615 620

Leu Asp Lys Arg Trp Ser Glu Met Glu Gly Ile Pro Gln Gly Glu Ile  
625 630 635 640

Val Trp Asp Tyr Asp Trp Ile Asn Arg Thr Phe Lys Ala Glu Asn Phe

645

650

655

Gln Ile Lys Gly Gly Ser Ala Val Val Ser Arg Asn Val Ser Ser Ile  
660 665 670

Glu Gly Asn Trp Thr Val Ser Asn Asn Ala Asn Ala Thr Phe Gly Val  
675 680 685

Val Pro Asn Gln Gln Asn Thr Ile Cys Thr Arg Ser Asp Trp Thr Gly  
690 695 700

Leu Thr Thr Cys Lys Thr Val Asn Leu Thr Asp Lys Lys Val Ile Asp  
705 710 715 720

Ser Ile Pro Thr Thr Gln Ile Asn Gly Ser Ile Asn Leu Thr Asp Asn  
725 730 735

Ala Thr Val Asn Ile Asn Gly Leu Ala Lys Leu Asn Gly Asn Val Thr  
740 745 750

Leu Ile Asn His Ser Gln Phe Thr Leu Ser Asn Asn Ala Thr Gln Ile  
755 760 765

Gly Asn Ile Lys Leu Ser Asn His Ala Asn Ala Arg Val Asn Asn Ala  
770 775 780

Thr Leu Met Gly Asp Val Asn Leu Ala Asp Thr Ser Arg Phe Thr Leu  
785 790 795 800

Ser Asn Gln Ala Thr Gln Ile Gly Thr Ile Ser Leu His Gln Gln Ala  
805 810 815

Gln Ala Thr Val Asp Asn Ala Asn Leu Asn Gly Asn Val His Leu Thr  
820 825 830

Asp Ser Ala Arg Phe Ser Leu Lys Asn Ser His Phe Ser His Gln Ile  
835 840 845

Gln Gly Asp Lys Asp Thr Thr Val Thr Leu Glu Asn Ala Thr Trp Thr  
850 855 860

Met Pro Ser Asp Thr Thr Leu Gln Asn Leu Thr Leu Asn Asn Ser Thr  
865 870 875 880

Val Thr Leu Asn Ser Ala Tyr Ser Ala Ser Ser Asn Asn Ala Pro Arg  
 885 890 895

Arg Arg Arg Ser Leu Glu Thr Glu Thr Thr Pro Thr Ser Ala Glu His  
 900 905 910

Arg Phe Asn Thr Leu Thr Val Asn Gly Lys Leu Ser Gly Gln Gly Thr  
 915 920 925

Phe Gln Phe Thr Pro Ser Leu Phe Gly Tyr Glu Ser Asp Lys Leu Lys  
 930 935 940

Leu Ser Asn Asp Ala Glu Gly Asp Tyr Thr Leu Ser Val Arg Asn Thr  
 945 950 955 960

Gly Lys Glu Pro Val Thr Leu Glu Gln Leu Thr Leu Val Glu Ser Lys  
 965 970 975

Asp Asn Lys Pro Leu Ser Asp Lys Leu Lys Phe Thr Leu Glu Asn Asp  
 980 985 990

His Val Asp Ala Gly Ala Leu Arg Tyr Lys Leu Val Lys Asn Lys Gly  
 995 1000 1005

Glu Phe Arg Leu His Asn Pro Ile Lys Glu Gln Glu Leu Arg Ser  
 1010 1015 1020

Asp Leu Val Arg Ala Glu Gln Ala Glu Arg Thr Leu Glu Ala Lys  
 1025 1030 1035

Gln Val Glu Gln Thr Ala Glu Thr Gln Thr Ser Asn Ala Arg Val  
 1040 1045 1050

Arg Ser Arg Arg Ala Val Leu Ser Asp Thr Pro Ser Ala Gln Ser  
 1055 1060 1065

Leu Leu Asn Ala Leu Glu Val Lys Gln Ala Glu Pro Asn Ala Lys  
 1070 1075 1080

Thr Gln Lys Ser Lys Ala Lys Thr Lys Lys Ala Arg Ser Lys Arg  
 1085 1090 1095

|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|
| Ala  | Leu | Arg | Glu | Ala | Phe | Ser  | Asp | Thr | Pro | Pro | Asp  | Leu | Ser | Gln |
| 1100 |     |     |     |     |     | 1105 |     |     |     |     | 1110 |     |     |     |
| Leu  | Asn | Val | Leu | Glu | Ala | Ala  | Leu | Lys | Val | Ile | Asn  | Ala | Gln | Pro |
| 1115 |     |     |     |     |     | 1120 |     |     |     |     | 1125 |     |     |     |
| Gln  | Thr | Glu | Lys | Glu | Arg | Gln  | Ala | Gln | Glu | Glu | Glu  | Ala | Lys | Arg |
| 1130 |     |     |     |     |     | 1135 |     |     |     |     | 1140 |     |     |     |
| Gln  | Arg | Lys | Gln | Lys | Asp | Leu  | Ile | Ser | Arg | Tyr | Ser  | Asn | Ser | Ala |
| 1145 |     |     |     |     |     | 1150 |     |     |     |     | 1155 |     |     |     |
| Leu  | Ser | Glu | Leu | Ser | Ala | Thr  | Val | Asn | Ser | Met | Leu  | Ser | Val | Gln |
| 1160 |     |     |     |     |     | 1165 |     |     |     |     | 1170 |     |     |     |
| Asp  | Glu | Leu | Asp | Arg | Leu | Phe  | Val | Asp | Gln | Ala | Gln  | Ser | Ala | Leu |
| 1175 |     |     |     |     |     | 1180 |     |     |     |     | 1185 |     |     |     |
| Trp  | Thr | Asn | Ile | Ala | Gln | Asp  | Lys | Arg | Arg | Tyr | Asp  | Ser | Asp | Ala |
| 1190 |     |     |     |     |     | 1195 |     |     |     |     | 1200 |     |     |     |
| Phe  | Arg | Ala | Tyr | Gln | Gln | Lys  | Thr | Asn | Leu | Arg | Gln  | Ile | Gly | Val |
| 1205 |     |     |     |     |     | 1210 |     |     |     |     | 1215 |     |     |     |
| Gln  | Lys | Ala | Leu | Asp | Asn | Gly  | Arg | Ile | Gly | Ala | Val  | Phe | Ser | His |
| 1220 |     |     |     |     |     | 1225 |     |     |     |     | 1230 |     |     |     |
| Ser  | Arg | Ser | Asp | Asn | Thr | Phe  | Asp | Glu | Gln | Val | Lys  | Asn | His | Ala |
| 1235 |     |     |     |     |     | 1240 |     |     |     |     | 1245 |     |     |     |
| Thr  | Leu | Thr | Met | Met | Ser | Gly  | Phe | Ala | Gln | Tyr | Gln  | Trp | Gly | Asp |
| 1250 |     |     |     |     |     | 1255 |     |     |     |     | 1260 |     |     |     |
| Leu  | Gln | Phe | Gly | Val | Asn | Val  | Gly | Ala | Gly | Ile | Ser  | Ala | Ser | Lys |
| 1265 |     |     |     |     |     | 1270 |     |     |     |     | 1275 |     |     |     |
| Met  | Ala | Glu | Glu | Gln | Ser | Arg  | Lys | Ile | His | Arg | Lys  | Ala | Ile | Asn |
| 1280 |     |     |     |     |     | 1285 |     |     |     |     | 1290 |     |     |     |
| Tyr  | Gly | Val | Asn | Ala | Ser | Tyr  | Gln | Phe | Arg | Leu | Gly  | Gln | Leu | Gly |
| 1295 |     |     |     |     |     | 1300 |     |     |     |     | 1305 |     |     |     |

Ile Gln Pro Tyr Leu Gly Val Asn Arg Tyr Phe Ile Glu Arg Glu  
 1310 1315 1320

Asn Tyr Gln Ser Glu Glu Val Lys Val Gln Thr Pro Ser Leu Ala  
 1325 1330 1335

Phe Asn Arg Tyr Asn Ala Gly Ile Arg Val Asp Tyr Thr Phe Thr  
 1340 1345 1350

Pro Thr Asp Asn Ile Ser Val Lys Pro Tyr Phe Phe Val Asn Tyr  
 1355 1360 1365

Val Asp Val Ser Asn Ala Asn Val Gln Thr Thr Val Asn Ser Thr  
 1370 1375 1380

Met Leu Gln Gln Ser Phe Gly Arg Tyr Trp Gln Lys Glu Val Gly  
 1385 1390 1395

Leu Lys Ala Glu Ile Leu His Phe Gln Leu Ser Ala Phe Ile Ser  
 1400 1405 1410

Lys Ser Gln Gly Ser Gln Leu Gly Lys Gln Gln Asn Val Gly Val  
 1415 1420 1425

Lys Leu Gly Tyr Arg Trp  
 1430

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 <212> DNA  
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<220>  
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 tcagagaaaa ctcacataaa gtgcgggttat tttattagtg atattgtttt aatttttagtt 180  
 atctgtataa attacataca atattaatcc atcgcaagat tagattaccc actaagtatt 240  
 aagcaaaaaac ctagaaattt tggcttaatt actatatagt ttactcatt tattttcttt 300



|  |      |
|--|------|
| tgtgcctttt agttcatttt ttttagctgaa atccccttaga aaatcaccgc actttttattg | 360  |
| ttcaatagtc gtttaaccac gtatTTTTta atacgaaaaa ttacttaatt aaataaacat    | 420  |
| t atg aaa aaa act gta ttt cgt ctg aat ttt tta acc gct tgc att tca    | 469  |
| Met Lys Lys Thr Val Phe Arg Leu Asn Phe Leu Thr Ala Cys Ile Ser      |      |
| 1 5 10 15  |      |
| tta ggg ata gta tcg caa gcg tgg gca ggt cat act tat ttt ggg att      | 517  |
| Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr Phe Gly Ile      |      |
| 20 25 30   |      |
| gac tac caa tat tat cgt gat ttt gcc gag aat aaa ggg aag ttt aca      | 565  |
| Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe Thr      |      |
| 35 40 45   |      |
| gtt ggg gct caa gat att gat atc tac aat aaa aaa ggg gaa atg ata      | 613  |
| Val Gly Ala Gln Asp Ile Asp Ile Tyr Asn Lys Lys Gly Glu Met Ile      |      |
| 50 55 60   |      |
| ggg acg atg atg aaa ggt gtg cct atg cct gat tta tct tcc atg gtt      | 661  |
| Gly Thr Met Met Lys Gly Val Pro Met Pro Asp Leu Ser Ser Met Val      |      |
| 65 70 75 80  |      |
| cgt ggt ggt tat tca aca ttg ata agt gag cag cat tta att agc gtc      | 709  |
| Arg Gly Gly Tyr Ser Thr Leu Ile Ser Glu Gln His Leu Ile Ser Val      |      |
| 85 90 95   |      |
| gca cat aat gta ggg tat gat gtc gtt gat ttt ggt atg gag ggg gaa      | 757  |
| Ala His Asn Val Gly Tyr Asp Val Val Asp Phe Gly Met Glu Gly Glu      |      |
| 100 105 110  |      |
| aat cca gac caa cat cgt ttt aag tat aaa gtt gtt aaa cga tat aat      | 805  |
| Asn Pro Asp Gln His Arg Phe Lys Tyr Lys Val Val Lys Arg Tyr Asn      |      |
| 115 120 125  |      |
| tat aag agc ggt gat aga caa tat aat gat tat caa cat cca aga tta      | 853  |
| Tyr Lys Ser Gly Asp Arg Gln Tyr Asn Asp Tyr Gln His Pro Arg Leu      |      |
| 130 135 140  |      |
| gag aaa ttt gta acg gaa act gca cct att gaa atg gtt tca tat atg      | 901  |
| Glu Lys Phe Val Thr Glu Thr Ala Pro Ile Glu Met Val Ser Tyr Met      |      |
| 145 150 155 160  |      |
| gat ggt aat cat tac aaa aat ttt aat caa tat cct ttg cga gtt aga      | 949  |
| Asp Gly Asn His Tyr Lys Asn Phe Asn Gln Tyr Pro Leu Arg Val Arg      |      |
| 165 170 175  |      |
| gtt gga agt ggg cat caa tgg tgg aaa gac gat aat aat aaa acc att      | 997  |
| Val Gly Ser Gly His Gln Trp Trp Lys Asp Asp Asn Asn Lys Thr Ile      |      |
| 180 185 190  |      |
| gga gac tta gcc tat gga ggt tca tgg tta ata ggt gga aat acc ttt      | 1045 |
| Gly Asp Leu Ala Tyr Gly Gly Ser Trp Leu Ile Gly Gly Asn Thr Phe      |      |
| 195 200 205  |      |

|   |      |
|---|------|
| gaa gat gga cca gct ggt aac ggt aca tta gaa tta aat ggg cga gta<br>Glu Asp Gly Pro Ala Gly Asn Gly Thr Leu Glu Leu Asn Gly Arg Val<br>210 215 220     | 1093 |
| caa aat cct aat aaa tat ggt cca cta cct acg gca ggt tca ttc ggg<br>Gln Asn Pro Asn Lys Tyr Gly Pro Leu Pro Thr Ala Gly Ser Phe Gly<br>225 230 235 240 | 1141 |
| gat agt ggt tct cca atg ttt att tat gat aag gaa gtt aag aaa tgg<br>Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp Lys Glu Val Lys Lys Trp<br>245 250 255     | 1189 |
| tta tta aat ggc gtg tta cgt gaa gga aat cct tat gct gca gta gga<br>Leu Leu Asn Gly Val Leu Arg Glu Gly Asn Pro Tyr Ala Ala Val Gly<br>260 265 270     | 1237 |
| aac agc tat caa att aca cga aaa gat tat ttt caa ggt att ctt aat<br>Asn Ser Tyr Gln Ile Thr Arg Lys Asp Tyr Phe Gln Gly Ile Leu Asn<br>275 280 285     | 1285 |
| caa gac att aca gct aat ttt tgg gat act aat gct gaa tat aga ttt<br>Gln Asp Ile Thr Ala Asn Phe Trp Asp Thr Asn Ala Glu Tyr Arg Phe<br>290 295 300     | 1333 |
| aat ata ggg agt gac cac aat gga aga gtg gca aca atc aaa agt aca<br>Asn Ile Gly Ser Asp His Asn Gly Arg Val Ala Thr Ile Lys Ser Thr<br>305 310 315 320 | 1381 |
| tta cct aaa aaa gct att cag cct gaa cga ata gtg ggt ctt tat gat<br>Leu Pro Lys Lys Ala Ile Gln Pro Glu Arg Ile Val Gly Leu Tyr Asp<br>325 330 335     | 1429 |
| aat agc caa ctt cat gat gct aga gat aaa aat ggc gat gaa tct ccc<br>Asn Ser Gln Leu His Asp Ala Arg Asp Lys Asn Gly Asp Glu Ser Pro<br>340 345 350     | 1477 |
| tct tat aaa ggt cct aat cca tgg teg cca gca tta cat cat ggg aaa<br>Ser Tyr Lys Gly Pro Asn Pro Trp Ser Pro Ala Leu His His Gly Lys<br>355 360 365     | 1525 |
| agt att tac ttt ggc gat caa gga aca gga act tta aca att gaa aat<br>Ser Ile Tyr Phe Gly Asp Gln Gly Thr Gly Thr Leu Thr Ile Glu Asn<br>370 375 380     | 1573 |
| aat ata aat caa ggt gca ggt gga ttg tat ttt gaa ggt aat ttt gtt<br>Asn Ile Asn Gln Gly Ala Gly Gly Leu Tyr Phe Glu Gly Asn Phe Val<br>385 390 395 400 | 1621 |
| gta aaa ggc aat caa aat aat ata act tgg caa ggt gca ggc gtt tct<br>Val Lys Gly Asn Gln Asn Asn Ile Thr Trp Gln Gly Ala Gly Val Ser<br>405 410 415     | 1669 |
| gtt gga gaa gaa agt act gtt gaa tgg cag gtg cat aat cca gaa ggc<br>Val Gly Glu Glu Ser Thr Val Glu Trp Gln Val His Asn Pro Glu Gly<br>420 425 430     | 1717 |
| gat cgc tta tcc aaa att ggg ctg gga acc tta ctt gtt aat ggt aaa   | 1765 |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|--|
| Asp | Arg | Leu | Ser | Lys | Ile | Gly | Leu | Gly | Thr | Leu | Leu | Val | Asn | Gly | Lys |      |  |
|     |     | 435 |     |     |     |     | 440 |     |     |     |     | 445 |     |     |     |      |  |
| ggg | aaa | aac | tta | gga | agc | ctg | agt | gtc | ggc | aac | ggc | ttg | gtt | gtg | tta | 1813 |  |
| Gly | Lys | Asn | Leu | Gly | Ser | Leu | Ser | Val | Gly | Asn | Gly | Leu | Val | Val | Leu |      |  |
|     |     | 450 |     |     |     | 455 |     |     |     |     | 460 |     |     |     |     |      |  |
| gat | caa | caa | gca | gat | gaa | tca | ggc | caa | aaa | caa | gcc | ttt | aaa | gaa | gtt | 1861 |  |
| Asp | Gln | Gln | Ala | Asp | Glu | Ser | Gly | Gln | Lys | Gln | Ala | Phe | Lys | Glu | Val |      |  |
|     |     |     |     |     | 470 |     |     |     |     | 475 |     |     |     |     | 480 |      |  |
| ggc | att | gta | agt | ggc | aga | gct | acc | gtt | caa | cta | aat | agt | gca | gat | caa | 1909 |  |
| Gly | Ile | Val | Ser | Gly | Arg | Ala | Thr | Val | Gln | Leu | Asn | Ser | Ala | Asp | Gln |      |  |
|     |     |     |     | 485 |     |     |     |     | 490 |     |     |     |     |     | 495 |      |  |
| gtt | gat | cct | aac | aat | att | tat | ttc | ggc | ttt | cgt | ggc | ggc | cgc | tta | gat | 1957 |  |
| Val | Asp | Pro | Asn | Asn | Ile | Tyr | Phe | Gly | Phe | Arg | Gly | Gly | Arg | Leu | Asp |      |  |
|     |     |     | 500 |     |     |     |     | 505 |     |     |     |     | 510 |     |     |      |  |
| ctt | aat | ggg | cat | tca | tta | acc | ttt | gaa | cgt | atc | caa | aat | acg | gat | gaa | 2005 |  |
| Leu | Asn | Gly | His | Ser | Leu | Thr | Phe | Glu | Arg | Ile | Gln | Asn | Thr | Asp | Glu |      |  |
|     |     | 515 |     |     |     |     | 520 |     |     |     |     | 525 |     |     |     |      |  |
| ggc | gcg | atg | att | gtg | aac | cac | aac | gct | tct | caa | acc | gca | aat | att | acg | 2053 |  |
| Gly | Ala | Met | Ile | Val | Asn | His | Asn | Ala | Ser | Gln | Thr | Ala | Asn | Ile | Thr |      |  |
|     |     | 530 |     |     |     | 535 |     |     |     |     | 540 |     |     |     |     |      |  |
| att | aca | ggc | aac | gca | act | att | aat | tca | gat | agc | aaa | caa | ctt | act | aat | 2101 |  |
| Ile | Thr | Gly | Asn | Ala | Thr | Ile | Asn | Ser | Asp | Ser | Lys | Gln | Leu | Thr | Asn |      |  |
|     |     |     |     |     | 550 |     |     |     |     | 555 |     |     |     |     | 560 |      |  |
| aaa | aaa | gat | att | gca | ttt | aac | ggc | tgg | ttt | ggc | gag | caa | gat | aaa | gct | 2149 |  |
| Lys | Lys | Asp | Ile | Ala | Phe | Asn | Gly | Trp | Phe | Gly | Glu | Gln | Asp | Lys | Ala |      |  |
|     |     |     |     | 565 |     |     |     | 570 |     |     |     |     |     | 575 |     |      |  |
| aaa | aca | aat | ggc | cgt | tta | aat | gtg | aat | tat | caa | cca | gtt | aat | gca | gaa | 2197 |  |
| Lys | Thr | Asn | Gly | Arg | Leu | Asn | Val | Asn | Tyr | Gln | Pro | Val | Asn | Ala | Glu |      |  |
|     |     |     | 580 |     |     |     |     | 585 |     |     |     |     | 590 |     |     |      |  |
| aat | cat | ttg | ttg | ctt | tct | ggg | ggg | aca | aat | tta | aac | ggc | aat | atc | acg | 2245 |  |
| Asn | His | Leu | Leu | Leu | Ser | Gly | Gly | Thr | Asn | Leu | Asn | Gly | Asn | Ile | Thr |      |  |
|     |     |     | 595 |     |     |     | 600 |     |     |     |     | 605 |     |     |     |      |  |
| caa | aat | ggc | ggc | acg | tta | gtt | ttt | agt | ggc | cgt | cca | acg | cct | cat | gct | 2293 |  |
| Gln | Asn | Gly | Gly | Thr | Leu | Val | Phe | Ser | Gly | Arg | Pro | Thr | Pro | His | Ala |      |  |
|     |     | 610 |     |     |     | 615 |     |     |     |     | 620 |     |     |     |     |      |  |
| tac | aat | cat | tta | aga | aga | gac | ttg | tct | aac | atg | gaa | ggc | atc | cca | caa | 2341 |  |
| Tyr | Asn | His | Leu | Arg | Arg | Asp | Leu | Ser | Asn | Met | Glu | Gly | Ile | Pro | Gln |      |  |
|     |     |     |     |     | 630 |     |     |     |     | 635 |     |     |     |     | 640 |      |  |
| ggc | gaa | att | gtg | tgg | gat | cac | gat | tgg | atc | aac | cgc | aca | ttt | aaa | gct | 2389 |  |
| Gly | Glu | Ile | Val | Trp | Asp | His | Asp | Trp | Ile | Asn | Arg | Thr | Phe | Lys | Ala |      |  |
|     |     |     |     | 645 |     |     |     |     | 650 |     |     |     |     | 655 |     |      |  |
| gaa | aac | ttc | caa | att | aaa | ggc | gga | agt | gcg | gtg | gtt | tct | cgc | aat | gtt | 2437 |  |
| Glu | Asn | Phe | Gln | Ile | Lys | Gly | Gly | Ser | Ala | Val | Val | Ser | Arg | Asn | Val |      |  |

| 660   | 665 | 670 |      |
|---|-----|-----|------|
| tct tca att gag gga aat tgg aca gtc agc aat aat gca aat gcc aca<br>Ser Ser Ile Glu Gly Asn Trp Thr Val Ser Asn Asn Ala Asn Ala Thr<br>675 680 685     |     |     | 2485 |
| ttt ggt gtt gtg cca aat cag caa aat acc att tgc acg cgt tca gat<br>Phe Gly Val Val Pro Asn Gln Gln Asn Thr Ile Cys Thr Arg Ser Asp<br>690 695 700     |     |     | 2533 |
| tgg aca gga tta acg act tgt aaa aca gtt gat tta acc gat aaa aaa<br>Trp Thr Gly Leu Thr Thr Cys Lys Thr Val Asp Leu Thr Asp Lys Lys<br>705 710 715 720 |     |     | 2581 |
| gtt att aat tcc ata ccg aca aca caa att aat ggt tct att aat tta<br>Val Ile Asn Ser Ile Pro Thr Thr Gln Ile Asn Gly Ser Ile Asn Leu<br>725 730 735     |     |     | 2629 |
| act gat aat gca aca gtg aat att cat ggt tta gca aaa ctt aat ggt<br>Thr Asp Asn Ala Thr Val Asn Ile His Gly Leu Ala Lys Leu Asn Gly<br>740 745 750     |     |     | 2677 |
| aat gtc act tta ata gat cac agc caa ttt aca ttg agc aac aat gcc<br>Asn Val Thr Leu Ile Asp His Ser Gln Phe Thr Leu Ser Asn Asn Ala<br>755 760 765     |     |     | 2725 |
| acc caa aca ggc aat atc aaa ctt tca aat cac gca aat gca acg gtg<br>Thr Gln Thr Gly Asn Ile Lys Leu Ser Asn His Ala Asn Ala Thr Val<br>770 775 780     |     |     | 2773 |
| gac aat gca aat ttg aac ggt aat gtg aat tta atg gat tct gct caa<br>Asp Asn Ala Asn Leu Asn Gly Asn Val Asn Leu Met Asp Ser Ala Gln<br>785 790 795 800 |     |     | 2821 |
| ttt tct tta aaa aac agc cat ttt tcg cac caa atc caa ggt ggg gaa<br>Phe Ser Leu Lys Asn Ser His Phe Ser His Gln Ile Gln Gly Gly Glu<br>805 810 815     |     |     | 2869 |
| gac aca aca gtg atg ttg gaa aat gcg act tgg aca atg cct agc gat<br>Asp Thr Thr Val Met Leu Glu Asn Ala Thr Trp Thr Met Pro Ser Asp<br>820 825 830     |     |     | 2917 |
| acc aca ttg cag aat tta acg cta aat aat agt act gtt acg tta aat<br>Thr Thr Leu Gln Asn Leu Thr Leu Asn Asn Ser Thr Val Thr Leu Asn<br>835 840 845     |     |     | 2965 |
| tca gct tat tca gct atc tca aat aat gcg cca cgc cgt cgc cgc cgt<br>Ser Ala Tyr Ser Ala Ile Ser Asn Asn Ala Pro Arg Arg Arg Arg Arg<br>850 855 860     |     |     | 3013 |
| tca tta gag acg gaa aca acg cca aca tcg gca gaa cat cgt ttc aac<br>Ser Leu Glu Thr Glu Thr Thr Pro Thr Ser Ala Glu His Arg Phe Asn<br>865 870 875 880 |     |     | 3061 |
| aca ttg aca gta aat ggt aaa ttg agc ggg caa ggc aca ttc caa ttt<br>Thr Leu Thr Val Asn Gly Lys Leu Ser Gly Gln Gly Thr Phe Gln Phe<br>885 890 895     |     |     | 3109 |

|   |      |
|---|------|
| act tca tct tta ttt ggc tat aaa agc gat aaa tta aaa tta tcc aat | 3157 |
| Thr Ser Ser Leu Phe Gly Tyr Lys Ser Asp Lys Leu Lys Leu Ser Asn |      |
| 900 905 910   |      |
| gac gct gag ggc gat tac aca tta tct gtt cgc aac aca ggc aaa gaa | 3205 |
| Asp Ala Glu Gly Asp Tyr Thr Leu Ser Val Arg Asn Thr Gly Lys Glu |      |
| 915 920 925   |      |
| ccc gtg acc ttt ggg caa tta act ttg gtt gaa agc aaa gat aat aaa | 3253 |
| Pro Val Thr Phe Gly Gln Leu Thr Leu Val Glu Ser Lys Asp Asn Lys |      |
| 930 935 940   |      |
| ccg tta tca gac aaa ctc aca ttc acg tta gaa aat gac cac gtt gat | 3301 |
| Pro Leu Ser Asp Lys Leu Thr Phe Thr Leu Glu Asn Asp His Val Asp |      |
| 945 950 955 960   |      |
| gca ggt gca tta cgt tat aaa tta gtg aag aat gat ggc gaa ttc cgc | 3349 |
| Ala Gly Ala Leu Arg Tyr Lys Leu Val Lys Asn Asp Gly Glu Phe Arg |      |
| 965 970 975   |      |
| tta cat aac cca ata aaa gag cag gaa ttg cgc tct gat tta gta aga | 3397 |
| Leu His Asn Pro Ile Lys Glu Gln Glu Leu Arg Ser Asp Leu Val Arg |      |
| 980 985 990   |      |
| gca gag caa gca gaa cga aca tta gaa gcc aaa caa gtt gaa cag act | 3445 |
| Ala Glu Gln Ala Glu Arg Thr Leu Glu Ala Lys Gln Val Glu Gln Thr |      |
| 995 1000 1005   |      |
| gct aaa aca caa aca agt aag gca aga gtg cgg tca aga aga gcg     | 3490 |
| Ala Lys Thr Gln Thr Ser Lys Ala Arg Val Arg Ser Arg Arg Ala     |      |
| 1010 1015 1020  |      |
| gtg ttt tct gat ccc ctg cct gct caa agc ctg tta aaa gca tta     | 3535 |
| Val Phe Ser Asp Pro Leu Pro Ala Gln Ser Leu Leu Lys Ala Leu     |      |
| 1025 1030 1035  |      |
| gaa gcc aaa caa gct ctg act act gaa aca caa aca agt aag gca     | 3580 |
| Glu Ala Lys Gln Ala Leu Thr Thr Glu Thr Gln Thr Ser Lys Ala     |      |
| 1040 1045 1050  |      |
| aaa aaa gtg cgg tca aaa aga gct gcg aga gag ttt tct gat acc     | 3625 |
| Lys Lys Val Arg Ser Lys Arg Ala Ala Arg Glu Phe Ser Asp Thr     |      |
| 1055 1060 1065  |      |
| ctg cct gat caa ata tta caa gcc gca ctt gag gtt att gat gcc     | 3670 |
| Leu Pro Asp Gln Ile Leu Gln Ala Ala Leu Glu Val Ile Asp Ala     |      |
| 1070 1075 1080  |      |
| caa cag caa gtg aaa aaa gaa cct caa act caa gag gaa gaa gag     | 3715 |
| Gln Gln Gln Val Lys Lys Glu Pro Gln Thr Gln Glu Glu Glu Glu     |      |
| 1085 1090 1095  |      |
| aaa aga caa cgc aaa caa aaa gaa ttg atc agc cgt tac tca aat     | 3760 |
| Lys Arg Gln Arg Lys Gln Lys Glu Leu Ile Ser Arg Tyr Ser Asn     |      |
| 1100 1105 1110  |      |

|                             |                     |             |      |
|-----------------------------|---------------------|-------------|------|
| agt gcg tta tcg gag ttg tct | gcg aca gta aat agt | atg ctt tcc | 3805 |
| Ser Ala Leu Ser Glu Leu Ser | Ala Thr Val Asn Ser | Met Leu Ser |      |
| 1115                        | 1120                | 1125        |      |
| ggt caa gat gaa ttg gat cgt | ctt ttt gta gat caa | gca caa tct | 3850 |
| Val Gln Asp Glu Leu Asp Arg | Leu Phe Val Asp Gln | Ala Gln Ser |      |
| 1130                        | 1135                | 1140        |      |
| gcc gtg tgg aca aat atc gca | cag gat aaa aga cgc | tat gat tct | 3895 |
| Ala Val Trp Thr Asn Ile Ala | Gln Asp Lys Arg Arg | Tyr Asp Ser |      |
| 1145                        | 1150                | 1155        |      |
| gat gcg ttc cgt gct tat cag | cag aaa acg aac ttg | cgt caa att | 3940 |
| Asp Ala Phe Arg Ala Tyr Gln | Gln Lys Thr Asn Leu | Arg Gln Ile |      |
| 1160                        | 1165                | 1170        |      |
| ggg gtg caa aaa gcc tta gat | aat gga cga att ggg | gcg gtt ttc | 3985 |
| Gly Val Gln Lys Ala Leu Asp | Asn Gly Arg Ile Gly | Ala Val Phe |      |
| 1175                        | 1180                | 1185        |      |
| tcg cat agc cgt tca gat aat | acc ttt gac gaa cag | gtt aaa aat | 4030 |
| Ser His Ser Arg Ser Asp Asn | Thr Phe Asp Glu Gln | Val Lys Asn |      |
| 1190                        | 1195                | 1200        |      |
| cac gcg aca tta gcg atg atg | tcg ggt ttt gcc caa | tat caa tgg | 4075 |
| His Ala Thr Leu Ala Met Met | Ser Gly Phe Ala Gln | Tyr Gln Trp |      |
| 1205                        | 1210                | 1215        |      |
| ggc gat tta caa ttt ggt gta | aac gtg ggt gcg gga | att agt gcg | 4120 |
| Gly Asp Leu Gln Phe Gly Val | Asn Val Gly Ala Gly | Ile Ser Ala |      |
| 1220                        | 1225                | 1230        |      |
| agt aaa atg gct gaa gaa caa | agc cga aaa att cat | cga aaa gcg | 4165 |
| Ser Lys Met Ala Glu Glu Gln | Ser Arg Lys Ile His | Arg Lys Ala |      |
| 1235                        | 1240                | 1245        |      |
| ata aat tat ggt gtg aat gca | agt tat cag ttc cgt | tta ggg caa | 4210 |
| Ile Asn Tyr Gly Val Asn Ala | Ser Tyr Gln Phe Arg | Leu Gly Gln |      |
| 1250                        | 1255                | 1260        |      |
| ttg ggt att cag cct tat ttg | ggt gtt aat cga tat | ttt att gaa | 4255 |
| Leu Gly Ile Gln Pro Tyr Leu | Gly Val Asn Arg Tyr | Phe Ile Glu |      |
| 1265                        | 1270                | 1275        |      |
| cgt gaa aat tat caa tct gaa | gaa gtg aaa gtg caa | aca ccg agc | 4300 |
| Arg Glu Asn Tyr Gln Ser Glu | Glu Val Lys Val Gln | Thr Pro Ser |      |
| 1280                        | 1285                | 1290        |      |
| ctt gta ttt aat cgc tat aat | gct ggc att cga gtt | gat tat aca | 4345 |
| Leu Val Phe Asn Arg Tyr Asn | Ala Gly Ile Arg Val | Asp Tyr Thr |      |
| 1295                        | 1300                | 1305        |      |
| ttt acc ccg aca gat aat atc | agc att aag cct tat | ttc ttc gtc | 4390 |
| Phe Thr Pro Thr Asp Asn Ile | Ser Ile Lys Pro Tyr | Phe Phe Val |      |
| 1310                        | 1315                | 1320        |      |
| aat tat gtt gat gtt tca aac | gct aac gta caa acc | act gta aat | 4435 |

|      |     |     |     |     |     |      |     |     |          |     |      |     |     |     |      |  |
|------|-----|-----|-----|-----|-----|------|-----|-----|----------|-----|------|-----|-----|-----|------|--|
| Asn  | Tyr | Val | Asp | Val | Ser | Asn  | Ala | Asn | Val      | Gln | Thr  | Thr | Val | Asn |      |  |
| 1325 |     |     |     |     |     | 1330 |     |     |          |     | 1335 |     |     |     |      |  |
| cgc  | acg | atg | ttg | caa | caa | tca  | ttt | ggg | cgt      | tat | tg   | caa | aaa | gaa | 4480 |  |
| Arg  | Thr | Met | Leu | Gln | Gln | Ser  | Phe | Gly | Arg      | Tyr | Trp  | Gln | Lys | Glu |      |  |
| 1340 |     |     |     |     |     | 1345 |     |     |          |     | 1350 |     |     |     |      |  |
| gtg  | gga | tta | aag | gca | gaa | att  | tta | cat | ttc      | caa | ctt  | tcc | gct | ttt | 4525 |  |
| Val  | Gly | Leu | Lys | Ala | Glu | Ile  | Leu | His | Phe      | Gln | Leu  | Ser | Ala | Phe |      |  |
| 1355 |     |     |     |     |     | 1360 |     |     |          |     | 1365 |     |     |     |      |  |
| atc  | tca | aaa | tct | caa | gg  | tca  | caa | ctc | ggc      | aaa | cag  | caa | a   | gtg | 4570 |  |
| Ile  | Ser | Lys | Ser | Gln | Gly | Ser  | Gln | Leu | Gly      | Lys | Gln  | Gln | Asn | Val |      |  |
| 1370 |     |     |     |     |     | 1375 |     |     |          |     | 1380 |     |     |     |      |  |
| ggc  | gtg | aaa | ttg | ggg | tat | cgt  | tg  | taa | aaatcaac |     |      |     |     |     | 4605 |  |
| Gly  | Val | Lys | Leu | Gly | Tyr | Arg  | Trp |     |          |     |      |     |     |     |      |  |
| 1385 |     |     |     |     |     | 1390 |     |     |          |     |      |     |     |     |      |  |

<210> 11  
 <211> 1391  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 11

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Met | Lys | Lys | Thr | Val | Phe | Arg | Leu | Asn | Phe | Leu | Thr | Ala | Cys | Ile | Ser |  |
| 1   |     |     |     | 5   |     |     |     |     | 10  |     |     |     |     | 15  |     |  |
| Leu | Gly | Ile | Val | Ser | Gln | Ala | Trp | Ala | Gly | His | Thr | Tyr | Phe | Gly | Ile |  |
|     |     |     | 20  |     |     |     |     | 25  |     |     |     |     | 30  |     |     |  |
| Asp | Tyr | Gln | Tyr | Tyr | Arg | Asp | Phe | Ala | Glu | Asn | Lys | Gly | Lys | Phe | Thr |  |
|     |     | 35  |     |     |     |     | 40  |     |     |     |     | 45  |     |     |     |  |
| Val | Gly | Ala | Gln | Asp | Ile | Asp | Ile | Tyr | Asn | Lys | Lys | Gly | Glu | Met | Ile |  |
|     | 50  |     |     |     |     | 55  |     |     |     |     | 60  |     |     |     |     |  |
| Gly | Thr | Met | Met | Lys | Gly | Val | Pro | Met | Pro | Asp | Leu | Ser | Ser | Met | Val |  |
| 65  |     |     |     | 70  |     |     |     |     | 75  |     |     |     |     | 80  |     |  |
| Arg | Gly | Gly | Tyr | Ser | Thr | Leu | Ile | Ser | Glu | Gln | His | Leu | Ile | Ser | Val |  |
|     |     |     |     | 85  |     |     |     | 90  |     |     |     |     |     | 95  |     |  |
| Ala | His | Asn | Val | Gly | Tyr | Asp | Val | Val | Asp | Phe | Gly | Met | Glu | Gly | Glu |  |
|     |     |     | 100 |     |     |     | 105 |     |     |     |     |     | 110 |     |     |  |
| Asn | Pro | Asp | Gln | His | Arg | Phe | Lys | Tyr | Lys | Val | Val | Lys | Arg | Tyr | Asn |  |
|     |     | 115 |     |     |     |     | 120 |     |     |     |     | 125 |     |     |     |  |

Tyr Lys Ser Gly Asp Arg Gln Tyr Asn Asp Tyr Gln His Pro Arg Leu  
 130 135 140

Glu Lys Phe Val Thr Glu Thr Ala Pro Ile Glu Met Val Ser Tyr Met  
 145 150 155 160

Asp Gly Asn His Tyr Lys Asn Phe Asn Gln Tyr Pro Leu Arg Val Arg  
 165 170 175

Val Gly Ser Gly His Gln Trp Trp Lys Asp Asp Asn Asn Lys Thr Ile  
 180 185 190

Gly Asp Leu Ala Tyr Gly Gly Ser Trp Leu Ile Gly Gly Asn Thr Phe  
 195 200 205

Glu Asp Gly Pro Ala Gly Asn Gly Thr Leu Glu Leu Asn Gly Arg Val  
 210 215 220

Gln Asn Pro Asn Lys Tyr Gly Pro Leu Pro Thr Ala Gly Ser Phe Gly  
 225 230 235 240

Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp Lys Glu Val Lys Lys Trp  
 245 250 255

Leu Leu Asn Gly Val Leu Arg Glu Gly Asn Pro Tyr Ala Ala Val Gly  
 260 265 270

Asn Ser Tyr Gln Ile Thr Arg Lys Asp Tyr Phe Gln Gly Ile Leu Asn  
 275 280 285

Gln Asp Ile Thr Ala Asn Phe Trp Asp Thr Asn Ala Glu Tyr Arg Phe  
 290 295 300

Asn Ile Gly Ser Asp His Asn Gly Arg Val Ala Thr Ile Lys Ser Thr  
 305 310 315 320

Leu Pro Lys Lys Ala Ile Gln Pro Glu Arg Ile Val Gly Leu Tyr Asp  
 325 330 335

Asn Ser Gln Leu His Asp Ala Arg Asp Lys Asn Gly Asp Glu Ser Pro  
 340 345 350



Ser Tyr Lys Gly Pro Asn Pro Trp Ser Pro Ala Leu His His Gly Lys  
355 360 365

Ser Ile Tyr Phe Gly Asp Gln Gly Thr Gly Thr Leu Thr Ile Glu Asn  
370 375 380

Asn Ile Asn Gln Gly Ala Gly Gly Leu Tyr Phe Glu Gly Asn Phe Val  
385 390 395 400

Val Lys Gly Asn Gln Asn Asn Ile Thr Trp Gln Gly Ala Gly Val Ser  
405 410 415

Val Gly Glu Glu Ser Thr Val Glu Trp Gln Val His Asn Pro Glu Gly  
420 425 430

Asp Arg Leu Ser Lys Ile Gly Leu Gly Thr Leu Leu Val Asn Gly Lys  
435 440 445

Gly Lys Asn Leu Gly Ser Leu Ser Val Gly Asn Gly Leu Val Val Leu  
450 455 460

Asp Gln Gln Ala Asp Glu Ser Gly Gln Lys Gln Ala Phe Lys Glu Val  
465 470 475 480

Gly Ile Val Ser Gly Arg Ala Thr Val Gln Leu Asn Ser Ala Asp Gln  
485 490 495

Val Asp Pro Asn Asn Ile Tyr Phe Gly Phe Arg Gly Gly Arg Leu Asp  
500 505 510

Leu Asn Gly His Ser Leu Thr Phe Glu Arg Ile Gln Asn Thr Asp Glu  
515 520 525

Gly Ala Met Ile Val Asn His Asn Ala Ser Gln Thr Ala Asn Ile Thr  
530 535 540

Ile Thr Gly Asn Ala Thr Ile Asn Ser Asp Ser Lys Gln Leu Thr Asn  
545 550 555 560

Lys Lys Asp Ile Ala Phe Asn Gly Trp Phe Gly Glu Gln Asp Lys Ala  
565 570 575

Lys Thr Asn Gly Arg Leu Asn Val Asn Tyr Gln Pro Val Asn Ala Glu  
 580 585 590

Asn His Leu Leu Leu Ser Gly Gly Thr Asn Leu Asn Gly Asn Ile Thr  
 595 600 605

Gln Asn Gly Gly Thr Leu Val Phe Ser Gly Arg Pro Thr Pro His Ala  
 610 615 620

Tyr Asn His Leu Arg Arg Asp Leu Ser Asn Met Glu Gly Ile Pro Gln  
 625 630 635 640

Gly Glu Ile Val Trp Asp His Asp Trp Ile Asn Arg Thr Phe Lys Ala  
 645 650 655

Glu Asn Phe Gln Ile Lys Gly Gly Ser Ala Val Val Ser Arg Asn Val  
 660 665 670

Ser Ser Ile Glu Gly Asn Trp Thr Val Ser Asn Asn Ala Asn Ala Thr  
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Phe Gly Val Val Pro Asn Gln Gln Asn Thr Ile Cys Thr Arg Ser Asp  
 690 695 700

Trp Thr Gly Leu Thr Thr Cys Lys Thr Val Asp Leu Thr Asp Lys Lys  
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Val Ile Asn Ser Ile Pro Thr Thr Gln Ile Asn Gly Ser Ile Asn Leu  
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Thr Asp Asn Ala Thr Val Asn Ile His Gly Leu Ala Lys Leu Asn Gly  
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Asn Val Thr Leu Ile Asp His Ser Gln Phe Thr Leu Ser Asn Asn Ala  
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Thr Gln Thr Gly Asn Ile Lys Leu Ser Asn His Ala Asn Ala Thr Val  
 770 775 780

Asp Asn Ala Asn Leu Asn Gly Asn Val Asn Leu Met Asp Ser Ala Gln  
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Phe Ser Leu Lys Asn Ser His Phe Ser His Gln Ile Gln Gly Gly Glu

| 805  |     |     |     |     | 810  |     |     |     |     | 815  |     |     |     |     |     |  |
|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|--|
| Asp  | Thr | Thr | Val | Met | Leu  | Glu | Asn | Ala | Thr | Trp  | Thr | Met | Pro | Ser | Asp |  |
| 820  |     |     |     |     | 825  |     |     |     |     | 830  |     |     |     |     |     |  |
| Thr  | Thr | Leu | Gln | Asn | Leu  | Thr | Leu | Asn | Asn | Ser  | Thr | Val | Thr | Leu | Asn |  |
| 835  |     |     |     |     | 840  |     |     |     |     | 845  |     |     |     |     |     |  |
| Ser  | Ala | Tyr | Ser | Ala | Ile  | Ser | Asn | Asn | Ala | Pro  | Arg | Arg | Arg | Arg |     |  |
| 850  |     |     |     |     | 855  |     |     |     |     | 860  |     |     |     |     |     |  |
| Ser  | Leu | Glu | Thr | Glu | Thr  | Thr | Pro | Thr | Ser | Ala  | Glu | His | Arg | Phe | Asn |  |
| 865  |     |     |     |     | 870  |     |     |     |     | 875  |     |     |     |     | 880 |  |
| Thr  | Leu | Thr | Val | Asn | Gly  | Lys | Leu | Ser | Gly | Gln  | Gly | Thr | Phe | Gln | Phe |  |
| 885  |     |     |     |     | 890  |     |     |     |     | 895  |     |     |     |     |     |  |
| Thr  | Ser | Ser | Leu | Phe | Gly  | Tyr | Lys | Ser | Asp | Lys  | Leu | Lys | Leu | Ser | Asn |  |
| 900  |     |     |     |     | 905  |     |     |     |     | 910  |     |     |     |     |     |  |
| Asp  | Ala | Glu | Gly | Asp | Tyr  | Thr | Leu | Ser | Val | Arg  | Asn | Thr | Gly | Lys | Glu |  |
| 915  |     |     |     |     | 920  |     |     |     |     | 925  |     |     |     |     |     |  |
| Pro  | Val | Thr | Phe | Gly | Gln  | Leu | Thr | Leu | Val | Glu  | Ser | Lys | Asp | Asn | Lys |  |
| 930  |     |     |     |     | 935  |     |     |     |     | 940  |     |     |     |     |     |  |
| Pro  | Leu | Ser | Asp | Lys | Leu  | Thr | Phe | Thr | Leu | Glu  | Asn | Asp | His | Val | Asp |  |
| 945  |     |     |     |     | 950  |     |     |     |     | 955  |     |     |     |     | 960 |  |
| Ala  | Gly | Ala | Leu | Arg | Tyr  | Lys | Leu | Val | Lys | Asn  | Asp | Gly | Glu | Phe | Arg |  |
| 965  |     |     |     |     | 970  |     |     |     |     | 975  |     |     |     |     |     |  |
| Leu  | His | Asn | Pro | Ile | Lys  | Glu | Gln | Glu | Leu | Arg  | Ser | Asp | Leu | Val | Arg |  |
| 980  |     |     |     |     | 985  |     |     |     |     | 990  |     |     |     |     |     |  |
| Ala  | Glu | Gln | Ala | Glu | Arg  | Thr | Leu | Glu | Ala | Lys  | Gln | Val | Glu | Gln | Thr |  |
| 995  |     |     |     |     | 1000 |     |     |     |     | 1005 |     |     |     |     |     |  |
| Ala  | Lys | Thr | Gln | Thr | Ser  | Lys | Ala | Arg | Val | Arg  | Ser | Arg | Arg | Ala |     |  |
| 1010 |     |     |     |     | 1015 |     |     |     |     | 1020 |     |     |     |     |     |  |
| Val  | Phe | Ser | Asp | Pro | Leu  | Pro | Ala | Gln | Ser | Leu  | Leu | Lys | Ala | Leu |     |  |
| 1025 |     |     |     |     | 1030 |     |     |     |     | 1035 |     |     |     |     |     |  |

|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|
| Glu  | Ala | Lys | Gln | Ala | Leu | Thr  | Thr | Glu | Thr | Gln | Thr  | Ser | Lys | Ala |
| 1040 |     |     |     |     |     | 1045 |     |     |     |     | 1050 |     |     |     |
| Lys  | Lys | Val | Arg | Ser | Lys | Arg  | Ala | Ala | Arg | Glu | Phe  | Ser | Asp | Thr |
| 1055 |     |     |     |     |     | 1060 |     |     |     |     | 1065 |     |     |     |
| Leu  | Pro | Asp | Gln | Ile | Leu | Gln  | Ala | Ala | Leu | Glu | Val  | Ile | Asp | Ala |
| 1070 |     |     |     |     |     | 1075 |     |     |     |     | 1080 |     |     |     |
| Gln  | Gln | Gln | Val | Lys | Lys | Glu  | Pro | Gln | Thr | Gln | Glu  | Glu | Glu | Glu |
| 1085 |     |     |     |     |     | 1090 |     |     |     |     | 1095 |     |     |     |
| Lys  | Arg | Gln | Arg | Lys | Gln | Lys  | Glu | Leu | Ile | Ser | Arg  | Tyr | Ser | Asn |
| 1100 |     |     |     |     |     | 1105 |     |     |     |     | 1110 |     |     |     |
| Ser  | Ala | Leu | Ser | Glu | Leu | Ser  | Ala | Thr | Val | Asn | Ser  | Met | Leu | Ser |
| 1115 |     |     |     |     |     | 1120 |     |     |     |     | 1125 |     |     |     |
| Val  | Gln | Asp | Glu | Leu | Asp | Arg  | Leu | Phe | Val | Asp | Gln  | Ala | Gln | Ser |
| 1130 |     |     |     |     |     | 1135 |     |     |     |     | 1140 |     |     |     |
| Ala  | Val | Trp | Thr | Asn | Ile | Ala  | Gln | Asp | Lys | Arg | Arg  | Tyr | Asp | Ser |
| 1145 |     |     |     |     |     | 1150 |     |     |     |     | 1155 |     |     |     |
| Asp  | Ala | Phe | Arg | Ala | Tyr | Gln  | Gln | Lys | Thr | Asn | Leu  | Arg | Gln | Ile |
| 1160 |     |     |     |     |     | 1165 |     |     |     |     | 1170 |     |     |     |
| Gly  | Val | Gln | Lys | Ala | Leu | Asp  | Asn | Gly | Arg | Ile | Gly  | Ala | Val | Phe |
| 1175 |     |     |     |     |     | 1180 |     |     |     |     | 1185 |     |     |     |
| Ser  | His | Ser | Arg | Ser | Asp | Asn  | Thr | Phe | Asp | Glu | Gln  | Val | Lys | Asn |
| 1190 |     |     |     |     |     | 1195 |     |     |     |     | 1200 |     |     |     |
| His  | Ala | Thr | Leu | Ala | Met | Met  | Ser | Gly | Phe | Ala | Gln  | Tyr | Gln | Trp |
| 1205 |     |     |     |     |     | 1210 |     |     |     |     | 1215 |     |     |     |
| Gly  | Asp | Leu | Gln | Phe | Gly | Val  | Asn | Val | Gly | Ala | Gly  | Ile | Ser | Ala |
| 1220 |     |     |     |     |     | 1225 |     |     |     |     | 1230 |     |     |     |
| Ser  | Lys | Met | Ala | Glu | Glu | Gln  | Ser | Arg | Lys | Ile | His  | Arg | Lys | Ala |
| 1235 |     |     |     |     |     | 1240 |     |     |     |     | 1245 |     |     |     |

Ile Asn Tyr Gly Val Asn Ala Ser Tyr Gln Phe Arg Leu Gly Gln  
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Leu Gly Ile Gln Pro Tyr Leu Gly Val Asn Arg Tyr Phe Ile Glu  
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Arg Glu Asn Tyr Gln Ser Glu Glu Val Lys Val Gln Thr Pro Ser  
 1280 1285 1290

Leu Val Phe Asn Arg Tyr Asn Ala Gly Ile Arg Val Asp Tyr Thr  
 1295 1300 1305

Phe Thr Pro Thr Asp Asn Ile Ser Ile Lys Pro Tyr Phe Phe Val  
 1310 1315 1320

Asn Tyr Val Asp Val Ser Asn Ala Asn Val Gln Thr Thr Val Asn  
 1325 1330 1335

Arg Thr Met Leu Gln Gln Ser Phe Gly Arg Tyr Trp Gln Lys Glu  
 1340 1345 1350

Val Gly Leu Lys Ala Glu Ile Leu His Phe Gln Leu Ser Ala Phe  
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| ttttagttat ctgtataaat tacatataat attaatccat cgcaagataa gattaccac  | 240 |
| taagtattaa gcaaaaacct agaaattttg gcttaattac tatatagttt tactgcttta | 300 |
| ttttcttttg tgccttttag ttcgtttttt tagctgaaat cccttagaaa atcacgcac  | 360 |
| ttttattggt caatagtcgt ttaaccacgt attttttaac acgaaaaatt acttaattaa | 420 |
| ataaacatt atg aaa aaa act gta ttt cgt ctg aac ttt tta acc gct tgc | 471 |
| Met Lys Lys Thr Val Phe Arg Leu Asn Phe Leu Thr Ala Cys           |     |
| 1 5 10  |     |
| att tca tta ggg ata gta tcg caa gcg tgg gca ggt cac act tat ttt   | 519 |
| Ile Ser Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr Phe   |     |
| 15 20 25 30   |     |
| ggg att gac tac caa tat tat cgt gat ttt gct gag aat aaa ggg aag   | 567 |
| Gly Ile Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly Lys   |     |
| 35 40 45  |     |
| ttt tca gtt ggg gct aaa aat att gag gtt tat aac aaa gag ggg act   | 615 |
| Phe Ser Val Gly Ala Lys Asn Ile Glu Val Tyr Asn Lys Glu Gly Thr   |     |
| 50 55 60  |     |
| tta gtt ggc aca tca atg aca aaa gcc ccg atg att gat ttt tct gtg   | 663 |
| Leu Val Gly Thr Ser Met Thr Lys Ala Pro Met Ile Asp Phe Ser Val   |     |
| 65 70 75  |     |
| gtg tcg cga aat ggg gtg gcg gca tta gta ggc gat cag tat att gtg   | 711 |
| Val Ser Arg Asn Gly Val Ala Ala Leu Val Gly Asp Gln Tyr Ile Val   |     |
| 80 85 90  |     |
| agt gtg gca cat aac ggt gga tat aat agc gtt gat ttt gga gca gaa   | 759 |
| Ser Val Ala His Asn Gly Gly Tyr Asn Ser Val Asp Phe Gly Ala Glu   |     |
| 95 100 105 110  |     |
| ggg cca aat ccc gat cag cat cgt ttt act tat caa att gta aaa aga   | 807 |
| Gly Pro Asn Pro Asp Gln His Arg Phe Thr Tyr Gln Ile Val Lys Arg   |     |
| 115 120 125   |     |
| aat aat tat aag cca ggc aaa gat aac cct tat cat ggt gac tat cac   | 855 |
| Asn Asn Tyr Lys Pro Gly Lys Asp Asn Pro Tyr His Gly Asp Tyr His   |     |
| 130 135 140   |     |
| atg cct cgt ttg cac aaa ttt gtc act gac gct gaa cca gca aag atg   | 903 |
| Met Pro Arg Leu His Lys Phe Val Thr Asp Ala Glu Pro Ala Lys Met   |     |
| 145 150 155   |     |
| aca gac aat atg aat gga aag aac tac gct gat tta agt aaa tat cct   | 951 |
| Thr Asp Asn Met Asn Gly Lys Asn Tyr Ala Asp Leu Ser Lys Tyr Pro   |     |
| 160 165 170   |     |
| gat cgt gtg cgt att ggt aca ggt gaa caa tgg tgg agg act gat gaa   | 999 |
| Asp Arg Val Arg Ile Gly Thr Gly Glu Gln Trp Trp Arg Thr Asp Glu   |     |
| 175 180 185 190   |     |

|   |      |
|---|------|
| gaa caa aag caa gga agt aag agt tca tgg ctt gct gat gct tat ctg | 1047 |
| Glu Gln Lys Gln Gly Ser Lys Ser Ser Trp Leu Ala Asp Ala Tyr Leu |      |
| 195 200 205   |      |
| tgg aga ata gca ggt aac aca cat tca caa agt gga gcg ggc aac ggc | 1095 |
| Trp Arg Ile Ala Gly Asn Thr His Ser Gln Ser Gly Ala Gly Asn Gly |      |
| 210 215 220   |      |
| acg gta aac tta agt gga gat atc aca aaa cca aat aac tat gga cct | 1143 |
| Thr Val Asn Leu Ser Gly Asp Ile Thr Lys Pro Asn Asn Tyr Gly Pro |      |
| 225 230 235   |      |
| ctt cct acg ggt gtt tcg ttt gga gat agt ggt tct cca atg ttt att | 1191 |
| Leu Pro Thr Gly Val Ser Phe Gly Asp Ser Gly Ser Pro Met Phe Ile |      |
| 240 245 250   |      |
| tat gat gca ata aaa caa aaa tgg ctt att aat ggc gta ttg caa act | 1239 |
| Tyr Asp Ala Ile Lys Gln Lys Trp Leu Ile Asn Gly Val Leu Gln Thr |      |
| 255 260 265 270   |      |
| ggt aac cct ttc tcg gga gct gga aat gga ttc caa tta att aga aaa | 1287 |
| Gly Asn Pro Phe Ser Gly Ala Gly Asn Gly Phe Gln Leu Ile Arg Lys |      |
| 275 280 285   |      |
| aat tgg ttt tat gat aat gtc ttt gta gaa gat ttg cct ata aca ttt | 1335 |
| Asn Trp Phe Tyr Asp Asn Val Phe Val Glu Asp Leu Pro Ile Thr Phe |      |
| 290 295 300   |      |
| tta gag cca aga agt aac ggt cat tat tca ttt act tca aat aat aat | 1383 |
| Leu Glu Pro Arg Ser Asn Gly His Tyr Ser Phe Thr Ser Asn Asn Asn |      |
| 305 310 315   |      |
| gga act ggt acg gtt act caa acg aat gaa aaa gtg agt atg cct caa | 1431 |
| Gly Thr Gly Thr Val Thr Gln Thr Asn Glu Lys Val Ser Met Pro Gln |      |
| 320 325 330   |      |
| ttt aaa gtc aga acg gtt cag tta ttt aat gaa gca tta aaa gaa aaa | 1479 |
| Phe Lys Val Arg Thr Val Gln Leu Phe Asn Glu Ala Leu Lys Glu Lys |      |
| 335 340 345 350   |      |
| gat aaa gaa cct gtt tat gct gca ggt ggt gta aat gct tat aaa cca | 1527 |
| Asp Lys Glu Pro Val Tyr Ala Ala Gly Gly Val Asn Ala Tyr Lys Pro |      |
| 355 360 365   |      |
| aga cta aat aat ggt aaa aat att tac ttt ggc gat cga gga aca gga | 1575 |
| Arg Leu Asn Asn Gly Lys Asn Ile Tyr Phe Gly Asp Arg Gly Thr Gly |      |
| 370 375 380   |      |
| act tta aca att gaa aat aat ata aat caa ggt gct ggt ggt ttg tat | 1623 |
| Thr Leu Thr Ile Glu Asn Asn Ile Asn Gln Gly Ala Gly Gly Leu Tyr |      |
| 385 390 395   |      |
| ttt gag ggt aac ttt acg gta tct tca gaa aat aat gca act tgg caa | 1671 |
| Phe Glu Gly Asn Phe Thr Val Ser Ser Glu Asn Asn Ala Thr Trp Gln |      |
| 400 405 410   |      |

|   |      |
|---|------|
| ggt gct gga gtg cat gta ggt gaa gac agt act gtt act tgg aaa gta | 1719 |
| Gly Ala Gly Val His Val Gly Glu Asp Ser Thr Val Thr Trp Lys Val |      |
| 415 420 425 430   |      |
| aac ggc gtg gaa cat gat cgc ctt tct aaa att ggt aaa gga acg ttg | 1767 |
| Asn Gly Val Glu His Asp Arg Leu Ser Lys Ile Gly Lys Gly Thr Leu |      |
| 435 440 445   |      |
| cat att caa gca aaa ggt gaa aac tta ggc tca att agc gta ggt gac | 1815 |
| His Ile Gln Ala Lys Gly Glu Asn Leu Gly Ser Ile Ser Val Gly Asp |      |
| 450 455 460   |      |
| ggc aaa gtc att tta gat caa caa gcc gat gag aac aac caa aaa caa | 1863 |
| Gly Lys Val Ile Leu Asp Gln Gln Ala Asp Glu Asn Asn Gln Lys Gln |      |
| 465 470 475   |      |
| gcc ttt aaa gaa gtt ggc att gta agt ggt aga gct acc gtt caa cta | 1911 |
| Ala Phe Lys Glu Val Gly Ile Val Ser Gly Arg Ala Thr Val Gln Leu |      |
| 480 485 490   |      |
| aat agt gca gat caa gtt gat cct aac aat att tat ttc gga ttt cgt | 1959 |
| Asn Ser Ala Asp Gln Val Asp Pro Asn Asn Ile Tyr Phe Gly Phe Arg |      |
| 495 500 505 510   |      |
| ggt ggt cgc tta gat ctt aac gga cat tca tta acc ttt aaa cgt atc | 2007 |
| Gly Gly Arg Leu Asp Leu Asn Gly His Ser Leu Thr Phe Lys Arg Ile |      |
| 515 520 525   |      |
| caa aat acg gac gag ggc gcg atg att gtg aac cat aat aca act caa | 2055 |
| Gln Asn Thr Asp Glu Gly Ala Met Ile Val Asn His Asn Thr Thr Gln |      |
| 530 535 540   |      |
| gtc gct aat att act att act ggg aac gaa agt att act gct cca tct | 2103 |
| Val Ala Asn Ile Thr Ile Thr Gly Asn Glu Ser Ile Thr Ala Pro Ser |      |
| 545 550 555   |      |
| aat aaa aat aat att aat aaa ctt gat tac agc aaa gaa att gct tac | 2151 |
| Asn Lys Asn Asn Ile Asn Lys Leu Asp Tyr Ser Lys Glu Ile Ala Tyr |      |
| 560 565 570   |      |
| aac ggt tgg ttt ggc gaa aca gat gaa aat aaa cac aat gga aga tta | 2199 |
| Asn Gly Trp Phe Gly Glu Thr Asp Glu Asn Lys His Asn Gly Arg Leu |      |
| 575 580 585 590   |      |
| aac ctt att tat aaa cca acc aca gaa gat cgt act ttg cta ctt tca | 2247 |
| Asn Leu Ile Tyr Lys Pro Thr Thr Glu Asp Arg Thr Leu Leu Leu Ser |      |
| 595 600 605   |      |
| ggt gga aca aat tta aaa ggc aat att act cag gaa ggc ggc act tta | 2295 |
| Gly Gly Thr Asn Leu Lys Gly Asn Ile Thr Gln Glu Gly Gly Thr Leu |      |
| 610 615 620   |      |
| gtg ttt agt ggt cgc cca act cca cac gct tac aat cat tta aat cgc | 2343 |
| Val Phe Ser Gly Arg Pro Thr Pro His Ala Tyr Asn His Leu Asn Arg |      |
| 625 630 635   |      |
| cca aac gag ctt ggg cga cct caa ggc gaa gtg gtt att gat gac gat | 2391 |



|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Pro | Asn | Glu | Leu | Gly | Arg | Pro | Gln | Gly | Glu | Val | Val | Ile | Asp | Asp | Asp |      |
| 640 |     |     |     |     |     | 645 |     |     |     |     | 650 |     |     |     |     |      |
| tg  | at  | ac  | cg  | ac  | tt  | aa  | gc  | ga  | aa  | tt  | ca  | at  | aa  | gg  | gg  | 2439 |
| Trp | Ile | Thr | Arg | Thr | Phe | Lys | Ala | Glu | Asn | Phe | Gln | Ile | Lys | Gly | Gly |      |
| 655 |     |     |     |     | 660 |     |     |     |     | 665 |     |     |     |     | 670 |      |
| ag  | gc  | gt  | gt  | tct | cg  | aa  | gt  | tct | tca | att | gag | gga | aat | tg  | aca | 2487 |
| Ser | Ala | Val | Val | Ser | Arg | Asn | Val | Ser | Ser | Ile | Glu | Gly | Asn | Trp | Thr |      |
|     |     |     |     | 675 |     |     |     |     | 680 |     |     |     |     | 685 |     |      |
| gt  | ag  | aa  | aa  | gc  | aa  | gc  | gc  | tt  | gg  | gt  | gt  | cc  | aa  | ca  | ca  | 2535 |
| Val | Ser | Asn | Asn | Ala | Asn | Ala | Ala | Phe | Gly | Val | Val | Pro | Asn | Gln | Gln |      |
|     |     |     | 690 |     |     |     |     | 695 |     |     |     |     | 700 |     |     |      |
| aa  | ac  | at  | tg  | ac  | cg  | tc  | ga  | tg  | ac  | gg  | tt  | ac  | ac  | tg  | aa  | 2583 |
| Asn | Thr | Ile | Cys | Thr | Arg | Ser | Asp | Trp | Thr | Gly | Leu | Thr | Thr | Cys | Lys |      |
|     |     | 705 |     |     |     |     | 710 |     |     |     |     | 715 |     |     |     |      |
| ac  | gt  | ga  | tt  | ac  | ga  | ac  | aa  | gt  | at  | aa  | tc  | at  | cc  | ac  | ac  | 2631 |
| Thr | Val | Asp | Leu | Thr | Asp | Thr | Lys | Val | Ile | Asn | Ser | Ile | Pro | Thr | Thr |      |
|     | 720 |     |     |     |     | 725 |     |     |     |     | 730 |     |     |     |     |      |
| ca  | at  | aa  | gg  | tct | at  | aa  | tt  | ac  | ga  | aa  | gc  | ac  | gt  | aa  | at  | 2679 |
| Gln | Ile | Asn | Gly | Ser | Ile | Asn | Leu | Thr | Asp | Asn | Ala | Thr | Val | Asn | Ile |      |
| 735 |     |     |     |     | 740 |     |     |     | 745 |     |     |     |     |     | 750 |      |
| ca  | gg  | tt  | gc  | aa  | ct  | aa  | gg  | aa  | gt  | ac  | tt  | at  | aa  | ca  | ag  | 2727 |
| His | Gly | Leu | Ala | Lys | Leu | Asn | Gly | Asn | Val | Thr | Leu | Ile | Asn | His | Ser |      |
|     |     |     |     | 755 |     |     |     |     | 760 |     |     |     |     | 765 |     |      |
| ca  | tt  | ac  | tt  | ag  | aa  | aa  | gc  | ac  | ca  | ac  | gg  | aa  | at  | ca  | ct  | 2775 |
| Gln | Phe | Thr | Leu | Ser | Asn | Asn | Ala | Thr | Gln | Thr | Gly | Asn | Ile | Gln | Leu |      |
|     |     |     | 770 |     |     |     |     | 775 |     |     |     |     | 780 |     |     |      |
| tc  | aa  | ca  | gc  | aa  | gc  | ac  | gt  | ga  | aa  | gc  | aa  | tt  | aa  | gg  | aa  | 2823 |
| Ser | Asn | His | Ala | Asn | Ala | Thr | Val | Asp | Asn | Ala | Asn | Leu | Asn | Gly | Asn |      |
|     |     | 785 |     |     |     | 790 |     |     |     |     | 795 |     |     |     |     |      |
| gt  | ca  | tt  | ac  | ga  | tct | gc  | ca  | tt  | tct | tt  | aa  | aa  | ag  | ca  | tt  | 2871 |
| Val | His | Leu | Thr | Asp | Ser | Ala | Gln | Phe | Ser | Leu | Lys | Asn | Ser | His | Phe |      |
|     | 800 |     |     |     |     | 805 |     |     |     |     | 810 |     |     |     |     |      |
| tc  | ca  | ca  | at  | ca  | gg  | ga  | aa  | ga  | ac  | ac  | gt  | ac  | tt  | ga  | aa  | 2919 |
| Ser | His | Gln | Ile | Gln | Gly | Asp | Lys | Asp | Thr | Thr | Val | Thr | Leu | Glu | Asn |      |
| 815 |     |     |     |     | 820 |     |     |     |     | 825 |     |     |     |     | 830 |      |
| gc  | ac  | tg  | ac  | at  | cc  | ag  | ga  | gc  | ac  | tt  | ca  | aa  | tt  | ac  | ca  | 2967 |
| Ala | Thr | Trp | Thr | Met | Pro | Ser | Asp | Ala | Thr | Leu | Gln | Asn | Leu | Thr | Leu |      |
|     |     |     |     | 835 |     |     |     |     | 840 |     |     |     |     | 845 |     |      |
| aa  | aa  | ag  | ac  | gt  | ac  | tt  | aa  | tc  | gc  | ta  | tc  | gc  | ag  | tc  | aa  | 3015 |
| Asn | Asn | Ser | Thr | Val | Thr | Leu | Asn | Ser | Ala | Tyr | Ser | Ala | Ser | Ser | Asn |      |
|     |     |     | 850 |     |     |     |     | 855 |     |     |     |     | 860 |     |     |      |
| aa  | gc  | cc  | cg  | ca  | cg  | cg  | tc  | tt  | ga  | ac  | ga  | ac  | ac  | cc  | ac  | 3063 |
| Asn | Ala | Pro | Arg | His | Arg | Arg | Ser | Leu | Glu | Thr | Glu | Thr | Thr | Pro | Thr |      |

| 865   | 870 | 875 |      |
|---|-----|-----|------|
| tcg gca gaa cat cgt ttc aac aca ttg aca gta aat ggt aaa ttg agc<br>Ser Ala Glu His Arg Phe Asn Thr Leu Thr Val Asn Gly Lys Leu Ser<br>880 885 890     |     |     | 3111 |
| ggg caa ggc aca ttc caa ttt act tca tct tta ttt ggc tat aaa agc<br>Gly Gln Gly Thr Phe Gln Phe Thr Ser Ser Leu Phe Gly Tyr Lys Ser<br>895 900 905 910 |     |     | 3159 |
| gat aaa tta aaa tta tcc aat gac gct gag ggc gat tac aca tta tct<br>Asp Lys Leu Lys Leu Ser Asn Asp Ala Glu Gly Asp Tyr Thr Leu Ser<br>915 920 925     |     |     | 3207 |
| gtt cgc aac aca ggc aaa gaa ccc gaa gcc ctt gag caa tta act ttg<br>Val Arg Asn Thr Gly Lys Glu Pro Glu Ala Leu Glu Gln Leu Thr Leu<br>930 935 940     |     |     | 3255 |
| gtt gaa agc aaa gat aat aaa ccg tta tca gac aaa ctc aaa ttt act<br>Val Glu Ser Lys Asp Asn Lys Pro Leu Ser Asp Lys Leu Lys Phe Thr<br>945 950 955     |     |     | 3303 |
| tta gaa aat gac cac gtt gat gca ggt gca tta cgt tat aaa tta gtg<br>Leu Glu Asn Asp His Val Asp Ala Gly Ala Leu Arg Tyr Lys Leu Val<br>960 965 970     |     |     | 3351 |
| aag aat aat ggc gaa ttc cgc ttg cat aac cca ata aaa gag cag gaa<br>Lys Asn Asn Gly Glu Phe Arg Leu His Asn Pro Ile Lys Glu Gln Glu<br>975 980 985 990 |     |     | 3399 |
| ttg cgc aat gat tta gta aga gca gag caa gca gaa cga aca tta gaa<br>Leu Arg Asn Asp Leu Val Arg Ala Glu Gln Ala Glu Arg Thr Leu Glu<br>995 1000 1005   |     |     | 3447 |
| gcc aaa caa gtt gaa cag act gct gaa aca caa aca agt aat gca<br>Ala Lys Gln Val Glu Gln Thr Ala Glu Thr Gln Thr Ser Asn Ala<br>1010 1015 1020          |     |     | 3492 |
| aga gtg cgg tca aaa aga gcg gtg ttt tct gat acc ctg cct gat<br>Arg Val Arg Ser Lys Arg Ala Val Phe Ser Asp Thr Leu Pro Asp<br>1025 1030 1035          |     |     | 3537 |
| caa agc cag tta gac gta tta caa gcc gaa caa gtt gaa ccg act<br>Gln Ser Gln Leu Asp Val Leu Gln Ala Glu Gln Val Glu Pro Thr<br>1040 1045 1050          |     |     | 3582 |
| gct gaa aaa caa aaa aat aag gca aaa aaa gtg cgg tca aaa aga<br>Ala Glu Lys Gln Lys Asn Lys Ala Lys Lys Val Arg Ser Lys Arg<br>1055 1060 1065          |     |     | 3627 |
| gcg gtg ttt tct gat acc ctg cct gat caa agc cag tta gac gta<br>Ala Val Phe Ser Asp Thr Leu Pro Asp Gln Ser Gln Leu Asp Val<br>1070 1075 1080          |     |     | 3672 |
| tta caa gcc gaa caa gtt gaa ccg act gct gaa aaa caa aaa aat<br>Leu Gln Ala Glu Gln Val Glu Pro Thr Ala Glu Lys Gln Lys Asn<br>1085 1090 1095          |     |     | 3717 |

|                 |                     |                             |      |
|-----------------|---------------------|-----------------------------|------|
| aag gca aaa aaa | gtg cgg tca aaa     | aga gcc gcg aga gag ttt tct | 3762 |
| Lys Ala Lys Lys | Val Arg Ser Lys     | Arg Ala Ala Arg Glu Phe Ser |      |
| 1100            | 1105                | 1110                        |      |
| gat acc ccg ctt | gat cta agc cgg tta | aag gta tta gaa gtc aaa     | 3807 |
| Asp Thr Pro Leu | Asp Leu Ser Arg     | Leu Lys Val Leu Glu Val Lys |      |
| 1115            | 1120                | 1125                        |      |
| ctt gag gtt att | aat gcc caa cag caa | gtg aaa aaa gaa cct caa     | 3852 |
| Leu Glu Val Ile | Asn Ala Gln Gln     | Gln Val Lys Lys Glu Pro Gln |      |
| 1130            | 1135                | 1140                        |      |
| gat caa gag aaa | caa cgc aaa caa aaa | gac ttg atc agc cgt tat     | 3897 |
| Asp Gln Glu Lys | Gln Arg Lys Gln Lys | Asp Leu Ile Ser Arg Tyr     |      |
| 1145            | 1150                | 1155                        |      |
| tca aat agt gcg | tta tca gaa tta tct | gca aca gta aat agt atg     | 3942 |
| Ser Asn Ser Ala | Leu Ser Glu Leu Ser | Ala Thr Val Asn Ser Met     |      |
| 1160            | 1165                | 1170                        |      |
| ctt tct gtt caa | gat gaa tta gat cgt | ctt ttt gta gat caa gca     | 3987 |
| Leu Ser Val Gln | Asp Glu Leu Asp Arg | Leu Phe Val Asp Gln Ala     |      |
| 1175            | 1180                | 1185                        |      |
| caa tct gcc gtg | tgg aca aat atc gca | cag gat aaa aga cgc tat     | 4032 |
| Gln Ser Ala Val | Trp Thr Asn Ile Ala | Gln Asp Lys Arg Arg Tyr     |      |
| 1190            | 1195                | 1200                        |      |
| gat tct gat gcg | ttc cgt gct tat cag | cag aaa acg aac tta cgt     | 4077 |
| Asp Ser Asp Ala | Phe Arg Ala Tyr Gln | Gln Lys Thr Asn Leu Arg     |      |
| 1205            | 1210                | 1215                        |      |
| caa att ggg gtg | caa aaa gcc tta gct | aat gga cga att ggg gca     | 4122 |
| Gln Ile Gly Val | Gln Lys Ala Leu Ala | Asn Gly Arg Ile Gly Ala     |      |
| 1220            | 1225                | 1230                        |      |
| gtt ttc tcg cat | agc cgt tca gat aat | act ttt gat gaa cag gtt     | 4167 |
| Val Phe Ser His | Ser Arg Ser Asp Asn | Thr Phe Asp Glu Gln Val     |      |
| 1235            | 1240                | 1245                        |      |
| aaa aat cac gcg | aca tta acg atg atg | tcg ggt ttt gcc caa tat     | 4212 |
| Lys Asn His Ala | Thr Leu Thr Met Met | Ser Gly Phe Ala Gln Tyr     |      |
| 1250            | 1255                | 1260                        |      |
| caa tgg ggc gat | tta caa ttt ggt gta | aac gtg gga acg gga atc     | 4257 |
| Gln Trp Gly Asp | Leu Gln Phe Gly Val | Asn Val Gly Thr Gly Ile     |      |
| 1265            | 1270                | 1275                        |      |
| agt gcg agt aaa | atg gct gaa gaa caa | agc cga aaa att cat cga     | 4302 |
| Ser Ala Ser Lys | Met Ala Glu Glu Gln | Ser Arg Lys Ile His Arg     |      |
| 1280            | 1285                | 1290                        |      |
| aaa gcg ata aat | tat ggc gtg aat gca | agt tat cag ttc cgt tta     | 4347 |
| Lys Ala Ile Asn | Tyr Gly Val Asn Ala | Ser Tyr Gln Phe Arg Leu     |      |
| 1295            | 1300                | 1305                        |      |

|  |      |
|--|------|
| ggg caa ttg ggc att cag cct tat ttt gga gtt aat cgc tat ttt        | 4392 |
| Gly Gln Leu Gly Ile Gln Pro Tyr Phe Gly Val Asn Arg Tyr Phe        |      |
| 1310 1315 1320   |      |
| att gaa cgt gaa aat tat caa tct gag gaa gtg aaa gtg aaa acg        | 4437 |
| Ile Glu Arg Glu Asn Tyr Gln Ser Glu Glu Val Lys Val Lys Thr        |      |
| 1325 1330 1335   |      |
| cct agc ctt gca ttt aat cgc tat aat gct ggc att cga gtt gat        | 4482 |
| Pro Ser Leu Ala Phe Asn Arg Tyr Asn Ala Gly Ile Arg Val Asp        |      |
| 1340 1345 1350   |      |
| tat aca ttt act ccg aca gat aat atc agc gtt aag cct tat ttc        | 4527 |
| Tyr Thr Phe Thr Pro Thr Asp Asn Ile Ser Val Lys Pro Tyr Phe        |      |
| 1355 1360 1365   |      |
| ttc gtc aat tat gtt gat gtt tca aac gct aac gta caa acc acg        | 4572 |
| Phe Val Asn Tyr Val Asp Val Ser Asn Ala Asn Val Gln Thr Thr        |      |
| 1370 1375 1380   |      |
| gta aat agc acg gtg ttg caa caa cca ttt gga cgt tat tgg caa        | 4617 |
| Val Asn Ser Thr Val Leu Gln Gln Pro Phe Gly Arg Tyr Trp Gln        |      |
| 1385 1390 1395   |      |
| aaa gaa gtg gga tta aaa gcg gaa att tta cat ttc caa ctt tct        | 4662 |
| Lys Glu Val Gly Leu Lys Ala Glu Ile Leu His Phe Gln Leu Ser        |      |
| 1400 1405 1410   |      |
| gct ttt att tct aaa tct caa ggt tcg caa ctc ggc aaa cag caa        | 4707 |
| Ala Phe Ile Ser Lys Ser Gln Gly Ser Gln Leu Gly Lys Gln Gln        |      |
| 1415 1420 1425   |      |
| aat gtg ggc gtg aaa ttg ggg tat cgt tgg taa aaatcaacat             | 4750 |
| Asn Val Gly Val Lys Leu Gly Tyr Arg Trp                            |      |
| 1430 1435  |      |
| aattgtatcg tttattgata aacaaggtgg ggcagatccc accttttttta tttcaataat | 4810 |
| ggaacttttat ttaattaaga gcatctaagt agcaccccat ataggggatt aattaagagg | 4870 |
| atttaataat gaatttaact aaacttttac cagcatttgc tgctgcagtc gtattatctg  | 4930 |
| cttgtgcaaa ggatgcacct gaaatgacaa aatcatctgc gcaaatagct gaaatgcaaa  | 4990 |
| cacttccaac aatcactgat aaaacagttg tatattcctg caataaacia actgtaactg  | 5050 |
| ccgtgtatca atttgaaaac caagaaccag ttgtgtcaat ggtaagtgtg ggcgatggca  | 5110 |
| ttattgcaaa agattttact cgtgataaat cacaaaatga ctttacaagt ttcgtttctg  | 5170 |
| gggattatgt ttggaatgta gatagtggct taacgttaga taaatttgat tctgttgtgc  | 5230 |
| ctgtcaattt aattc   | 5245 |

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<212> PRT

<213> Haemophilus influenzae

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Met Lys Lys Thr Val Phe Arg Leu Asn Phe Leu Thr Ala Cys Ile Ser  
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Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr Phe Gly Ile  
20 25 30

Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe Ser  
35 40 45

Val Gly Ala Lys Asn Ile Glu Val Tyr Asn Lys Glu Gly Thr Leu Val  
50 55 60

Gly Thr Ser Met Thr Lys Ala Pro Met Ile Asp Phe Ser Val Val Ser  
65 70 75 80

Arg Asn Gly Val Ala Ala Leu Val Gly Asp Gln Tyr Ile Val Ser Val  
85 90 95

Ala His Asn Gly Gly Tyr Asn Ser Val Asp Phe Gly Ala Glu Gly Pro  
100 105 110

Asn Pro Asp Gln His Arg Phe Thr Tyr Gln Ile Val Lys Arg Asn Asn  
115 120 125

Tyr Lys Pro Gly Lys Asp Asn Pro Tyr His Gly Asp Tyr His Met Pro  
130 135 140

Arg Leu His Lys Phe Val Thr Asp Ala Glu Pro Ala Lys Met Thr Asp  
145 150 155 160

Asn Met Asn Gly Lys Asn Tyr Ala Asp Leu Ser Lys Tyr Pro Asp Arg  
165 170 175

Val Arg Ile Gly Thr Gly Glu Gln Trp Trp Arg Thr Asp Glu Glu Gln  
180 185 190

Lys Gln Gly Ser Lys Ser Ser Trp Leu Ala Asp Ala Tyr Leu Trp Arg  
195 200 205

Ile Ala Gly Asn Thr His Ser Gln Ser Gly Ala Gly Asn Gly Thr Val  
 210 215 220

Asn Leu Ser Gly Asp Ile Thr Lys Pro Asn Asn Tyr Gly Pro Leu Pro  
 225 230 235 240

Thr Gly Val Ser Phe Gly Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp  
 245 250 255

Ala Ile Lys Gln Lys Trp Leu Ile Asn Gly Val Leu Gln Thr Gly Asn  
 260 265 270

Pro Phe Ser Gly Ala Gly Asn Gly Phe Gln Leu Ile Arg Lys Asn Trp  
 275 280 285

Phe Tyr Asp Asn Val Phe Val Glu Asp Leu Pro Ile Thr Phe Leu Glu  
 290 295 300

Pro Arg Ser Asn Gly His Tyr Ser Phe Thr Ser Asn Asn Asn Gly Thr  
 305 310 315 320

Gly Thr Val Thr Gln Thr Asn Glu Lys Val Ser Met Pro Gln Phe Lys  
 325 330 335

Val Arg Thr Val Gln Leu Phe Asn Glu Ala Leu Lys Glu Lys Asp Lys  
 340 345 350

Glu Pro Val Tyr Ala Ala Gly Gly Val Asn Ala Tyr Lys Pro Arg Leu  
 355 360 365

Asn Asn Gly Lys Asn Ile Tyr Phe Gly Asp Arg Gly Thr Gly Thr Leu  
 370 375 380

Thr Ile Glu Asn Asn Ile Asn Gln Gly Ala Gly Gly Leu Tyr Phe Glu  
 385 390 395 400

Gly Asn Phe Thr Val Ser Ser Glu Asn Asn Ala Thr Trp Gln Gly Ala  
 405 410 415

Gly Val His Val Gly Glu Asp Ser Thr Val Thr Trp Lys Val Asn Gly  
 420 425 430

Val Glu His Asp Arg Leu Ser Lys Ile Gly Lys Gly Thr Leu His Ile

|   |     |     |
|---|-----|-----|
| 435   | 440 | 445 |
| Gln Ala Lys Gly Glu Asn Leu Gly Ser Ile Ser Val Gly Asp Gly Lys |     |     |
| 450   | 455 | 460 |
| Val Ile Leu Asp Gln Gln Ala Asp Glu Asn Asn Gln Lys Gln Ala Phe |     |     |
| 465   | 470 | 475 |
| Lys Glu Val Gly Ile Val Ser Gly Arg Ala Thr Val Gln Leu Asn Ser |     |     |
| 485   | 490 | 495 |
| Ala Asp Gln Val Asp Pro Asn Asn Ile Tyr Phe Gly Phe Arg Gly Gly |     |     |
| 500   | 505 | 510 |
| Arg Leu Asp Leu Asn Gly His Ser Leu Thr Phe Lys Arg Ile Gln Asn |     |     |
| 515   | 520 | 525 |
| Thr Asp Glu Gly Ala Met Ile Val Asn His Asn Thr Thr Gln Val Ala |     |     |
| 530   | 535 | 540 |
| Asn Ile Thr Ile Thr Gly Asn Glu Ser Ile Thr Ala Pro Ser Asn Lys |     |     |
| 545   | 550 | 555 |
| Asn Asn Ile Asn Lys Leu Asp Tyr Ser Lys Glu Ile Ala Tyr Asn Gly |     |     |
| 565   | 570 | 575 |
| Trp Phe Gly Glu Thr Asp Glu Asn Lys His Asn Gly Arg Leu Asn Leu |     |     |
| 580   | 585 | 590 |
| Ile Tyr Lys Pro Thr Thr Glu Asp Arg Thr Leu Leu Leu Ser Gly Gly |     |     |
| 595   | 600 | 605 |
| Thr Asn Leu Lys Gly Asn Ile Thr Gln Glu Gly Gly Thr Leu Val Phe |     |     |
| 610   | 615 | 620 |
| Ser Gly Arg Pro Thr Pro His Ala Tyr Asn His Leu Asn Arg Pro Asn |     |     |
| 625   | 630 | 635 |
| Glu Leu Gly Arg Pro Gln Gly Glu Val Val Ile Asp Asp Asp Trp Ile |     |     |
| 645   | 650 | 655 |
| Thr Arg Thr Phe Lys Ala Glu Asn Phe Gln Ile Lys Gly Gly Ser Ala |     |     |
| 660   | 665 | 670 |

Val Val Ser Arg Asn Val Ser Ser Ile Glu Gly Asn Trp Thr Val Ser  
675 680 685

Asn Asn Ala Asn Ala Ala Phe Gly Val Val Pro Asn Gln Gln Asn Thr  
690 695 700

Ile Cys Thr Arg Ser Asp Trp Thr Gly Leu Thr Thr Cys Lys Thr Val  
705 710 715 720

Asp Leu Thr Asp Thr Lys Val Ile Asn Ser Ile Pro Thr Thr Gln Ile  
725 730 735

Asn Gly Ser Ile Asn Leu Thr Asp Asn Ala Thr Val Asn Ile His Gly  
740 745 750

Leu Ala Lys Leu Asn Gly Asn Val Thr Leu Ile Asn His Ser Gln Phe  
755 760 765

Thr Leu Ser Asn Asn Ala Thr Gln Thr Gly Asn Ile Gln Leu Ser Asn  
770 775 780

His Ala Asn Ala Thr Val Asp Asn Ala Asn Leu Asn Gly Asn Val His  
785 790 795 800

Leu Thr Asp Ser Ala Gln Phe Ser Leu Lys Asn Ser His Phe Ser His  
805 810 815

Gln Ile Gln Gly Asp Lys Asp Thr Thr Val Thr Leu Glu Asn Ala Thr  
820 825 830

Trp Thr Met Pro Ser Asp Ala Thr Leu Gln Asn Leu Thr Leu Asn Asn  
835 840 845

Ser Thr Val Thr Leu Asn Ser Ala Tyr Ser Ala Ser Ser Asn Asn Ala  
850 855 860

Pro Arg His Arg Arg Ser Leu Glu Thr Glu Thr Thr Pro Thr Ser Ala  
865 870 875 880

Glu His Arg Phe Asn Thr Leu Thr Val Asn Gly Lys Leu Ser Gly Gln  
885 890 895



Gly Thr Phe Gln Phe Thr Ser Ser Leu Phe Gly Tyr Lys Ser Asp Lys  
900 905 910

Leu Lys Leu Ser Asn Asp Ala Glu Gly Asp Tyr Thr Leu Ser Val Arg  
915 920 925

Asn Thr Gly Lys Glu Pro Glu Ala Leu Glu Gln Leu Thr Leu Val Glu  
930 935 940

Ser Lys Asp Asn Lys Pro Leu Ser Asp Lys Leu Lys Phe Thr Leu Glu  
945 950 955 960

Asn Asp His Val Asp Ala Gly Ala Leu Arg Tyr Lys Leu Val Lys Asn  
965 970 975

Asn Gly Glu Phe Arg Leu His Asn Pro Ile Lys Glu Gln Glu Leu Arg  
980 985 990

Asn Asp Leu Val Arg Ala Glu Gln Ala Glu Arg Thr Leu Glu Ala Lys  
995 1000 1005

Gln Val Glu Gln Thr Ala Glu Thr Gln Thr Ser Asn Ala Arg Val  
1010 1015 1020

Arg Ser Lys Arg Ala Val Phe Ser Asp Thr Leu Pro Asp Gln Ser  
1025 1030 1035

Gln Leu Asp Val Leu Gln Ala Glu Gln Val Glu Pro Thr Ala Glu  
1040 1045 1050

Lys Gln Lys Asn Lys Ala Lys Lys Val Arg Ser Lys Arg Ala Val  
1055 1060 1065

Phe Ser Asp Thr Leu Pro Asp Gln Ser Gln Leu Asp Val Leu Gln  
1070 1075 1080

Ala Glu Gln Val Glu Pro Thr Ala Glu Lys Gln Lys Asn Lys Ala  
1085 1090 1095

Lys Lys Val Arg Ser Lys Arg Ala Ala Arg Glu Phe Ser Asp Thr  
1100 1105 1110

|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|
| Pro  | Leu | Asp | Leu | Ser | Arg | Leu  | Lys | Val | Leu | Glu | Val  | Lys | Leu | Glu |
| 1115 |     |     |     |     |     | 1120 |     |     |     |     | 1125 |     |     |     |
| Val  | Ile | Asn | Ala | Gln | Gln | Gln  | Val | Lys | Lys | Glu | Pro  | Gln | Asp | Gln |
| 1130 |     |     |     |     |     | 1135 |     |     |     |     | 1140 |     |     |     |
| Glu  | Lys | Gln | Arg | Lys | Gln | Lys  | Asp | Leu | Ile | Ser | Arg  | Tyr | Ser | Asn |
| 1145 |     |     |     |     |     | 1150 |     |     |     |     | 1155 |     |     |     |
| Ser  | Ala | Leu | Ser | Glu | Leu | Ser  | Ala | Thr | Val | Asn | Ser  | Met | Leu | Ser |
| 1160 |     |     |     |     |     | 1165 |     |     |     |     | 1170 |     |     |     |
| Val  | Gln | Asp | Glu | Leu | Asp | Arg  | Leu | Phe | Val | Asp | Gln  | Ala | Gln | Ser |
| 1175 |     |     |     |     |     | 1180 |     |     |     |     | 1185 |     |     |     |
| Ala  | Val | Trp | Thr | Asn | Ile | Ala  | Gln | Asp | Lys | Arg | Arg  | Tyr | Asp | Ser |
| 1190 |     |     |     |     |     | 1195 |     |     |     |     | 1200 |     |     |     |
| Asp  | Ala | Phe | Arg | Ala | Tyr | Gln  | Gln | Lys | Thr | Asn | Leu  | Arg | Gln | Ile |
| 1205 |     |     |     |     |     | 1210 |     |     |     |     | 1215 |     |     |     |
| Gly  | Val | Gln | Lys | Ala | Leu | Ala  | Asn | Gly | Arg | Ile | Gly  | Ala | Val | Phe |
| 1220 |     |     |     |     |     | 1225 |     |     |     |     | 1230 |     |     |     |
| Ser  | His | Ser | Arg | Ser | Asp | Asn  | Thr | Phe | Asp | Glu | Gln  | Val | Lys | Asn |
| 1235 |     |     |     |     |     | 1240 |     |     |     |     | 1245 |     |     |     |
| His  | Ala | Thr | Leu | Thr | Met | Met  | Ser | Gly | Phe | Ala | Gln  | Tyr | Gln | Trp |
| 1250 |     |     |     |     |     | 1255 |     |     |     |     | 1260 |     |     |     |
| Gly  | Asp | Leu | Gln | Phe | Gly | Val  | Asn | Val | Gly | Thr | Gly  | Ile | Ser | Ala |
| 1265 |     |     |     |     |     | 1270 |     |     |     |     | 1275 |     |     |     |
| Ser  | Lys | Met | Ala | Glu | Glu | Gln  | Ser | Arg | Lys | Ile | His  | Arg | Lys | Ala |
| 1280 |     |     |     |     |     | 1285 |     |     |     |     | 1290 |     |     |     |
| Ile  | Asn | Tyr | Gly | Val | Asn | Ala  | Ser | Tyr | Gln | Phe | Arg  | Leu | Gly | Gln |
| 1295 |     |     |     |     |     | 1300 |     |     |     |     | 1305 |     |     |     |
| Leu  | Gly | Ile | Gln | Pro | Tyr | Phe  | Gly | Val | Asn | Arg | Tyr  | Phe | Ile | Glu |
| 1310 |     |     |     |     |     | 1315 |     |     |     |     | 1320 |     |     |     |
| Arg  | Glu | Asn | Tyr | Gln | Ser | Glu  | Glu | Val | Lys | Val | Lys  | Thr | Pro | Ser |

|                             |                     |             |
|-----------------------------|---------------------|-------------|
| 1325                        | 1330                | 1335        |
| Leu Ala Phe Asn Arg Tyr Asn | Ala Gly Ile Arg Val | Asp Tyr Thr |
| 1340                        | 1345                | 1350        |
| Phe Thr Pro Thr Asp Asn Ile | Ser Val Lys Pro Tyr | Phe Phe Val |
| 1355                        | 1360                | 1365        |
| Asn Tyr Val Asp Val Ser Asn | Ala Asn Val Gln Thr | Thr Val Asn |
| 1370                        | 1375                | 1380        |
| Ser Thr Val Leu Gln Gln Pro | Phe Gly Arg Tyr Trp | Gln Lys Glu |
| 1385                        | 1390                | 1395        |
| Val Gly Leu Lys Ala Glu Ile | Leu His Phe Gln Leu | Ser Ala Phe |
| 1400                        | 1405                | 1410        |
| Ile Ser Lys Ser Gln Gly Ser | Gln Leu Gly Lys Gln | Gln Asn Val |
| 1415                        | 1420                | 1425        |
| Gly Val Lys Leu Gly Tyr Arg | Trp                 |             |
| 1430                        | 1435                |             |

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<220>  
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| gaaaaacctt agaaaaaatg accgcacttt cagagaaaac tcacataaag tgcgggttatt | 120 |
| ttattagtga tattgtttta attatttgta taaattacat acaatattaa tccatcgaaa  | 180 |
| aataagatta ccactaagt attaagccaa aacctagaaa ttttggctta attactatat   | 240 |
| aattttactc ctttattttc ttttgtgcct tttagttagt tcgtttttta gctgaaatcc  | 300 |
| ctcagaaaat caccgcactt ttattgttca atagtcgttt aaccacgtat tttttaatac  | 360 |
| gaaaaattac ttaattaaat aaacatt atg aaa aaa act gta ttt cgt ctt aat  | 414 |
| Met Lys Lys Thr Val Phe Arg Leu Asn                                |     |

| 1   |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 5   |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| ttt | cta | acc | gct | tgt | att | tca | tta | ggg | ata | gta | tcg | caa | gcg | tgg | gca | 462  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phe | Leu | Thr | Ala | Cys | Ile | Ser | Leu | Gly | Ile | Val | Ser | Gln | Ala | Trp | Ala |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10  |     |     |     |     | 15  |     |     |     | 20  |     |     |     |     |     | 25  |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ggg | cac | act | tat | ttt | ggg | att | gac | tac | caa | tat | tat | cgt | gat | ttt | gcc | 510  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Gly | His | Thr | Tyr | Phe | Gly | Ile | Asp | Tyr | Gln | Tyr | Tyr | Arg | Asp | Phe | Ala |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     |     |     | 30  |     |     |     |     | 35  |     |     |     |     |     | 40  |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| gag | aat | aaa | ggg | aag | ttt | aca | gtt | ggg | gct | caa | gat | att | gat | atc | tac | 558  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Glu | Asn | Lys | Gly | Lys | Phe | Thr | Val | Gly | Ala | Gln | Asp | Ile | Asp | Ile | Tyr |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     |     |     | 45  |     |     |     |     | 50  |     |     |     |     | 55  |     |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| aat | aaa | aaa | ggg | gaa | atg | ata | ggg | acg | atg | atg | aaa | ggg | gtg | cct | atg | 606  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Asn | Lys | Lys | Gly | Glu | Met | Ile | Gly | Thr | Met | Met | Lys | Gly | Val | Pro | Met |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     |     |     | 60  |     |     |     | 65  |     |     |     |     |     | 70  |     |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| cct | gat | tta | tct | tcc | atg | gtt | cgt | ggg | ggg | tat | tca | aca | ttg | ata | agt | 654  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Pro | Asp | Leu | Ser | Ser | Met | Val | Arg | Gly | Gly | Tyr | Ser | Thr | Leu | Ile | Ser |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     | 75  |     |     |     |     | 80  |     |     |     |     | 85  |     |     |     |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| gag | cag | cat | tta | att | agc | gtc | gca | cat | aat | gta | ggg | tat | gat | gtc | gtt | 702  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Glu | Gln | His | Leu | Ile | Ser | Val | Ala | His | Asn | Val | Gly | Tyr | Asp | Val | Val |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 90  |     |     |     |     | 95  |     |     |     |     | 100 |     |     |     |     | 105 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| gat | ttt | ggg | atg | gag | ggg | gaa | aat | cca | gac | caa | cat | cgt | ttt | aag | tat | 750  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Asp | Phe | Gly | Met | Glu | Gly | Glu | Asn | Pro | Asp | Gln | His | Arg | Phe | Lys | Tyr |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     |     |     |     | 110 |     |     |     |     | 115 |     |     |     |     | 120 |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| aaa | gtt | gtt | aaa | cga | tat | aat | tat | aag | agc | ggg | gat | aga | caa | tat | aat | 798  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lys | Val | Val | Lys | Arg | Tyr | Asn | Tyr | Lys | Ser | Gly | Asp | Arg | Gln | Tyr | Asn |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     |     |     | 125 |     |     |     |     | 130 |     |     |     |     | 135 |     |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| gat | tat | caa | cat | cca | aga | tta | gag | aaa | ttt | gta | acg | gaa | act | gca | cct | 846  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Asp | Tyr | Gln | His | Pro | Arg | Leu | Glu | Lys | Phe | Val | Thr | Glu | Thr | Ala | Pro |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     |     | 140 |     |     |     |     | 145 |     |     |     |     | 150 |     |     |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| att | gaa | atg | gtt | tca | tat | atg | gat | ggg | aat | cat | tac | aaa | aat | ttt | aat | 894  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Ile | Glu | Met | Val | Ser | Tyr | Met | Asp | Gly | Asn | His | Tyr | Lys | Asn | Phe | Asn |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     | 155 |     |     |     |     | 160 |     |     |     |     | 165 |     |     |     |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| caa | tat | cct | ttg | cga | gtt | aga | gtt | gga | agt | ggg | cat | caa | tgg | tgg | aaa | 942  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Gln | Tyr | Pro | Leu | Arg | Val | Arg | Val | Gly | Ser | Gly | His | Gln | Trp | Trp | Lys |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 170 |     |     |     |     | 175 |     |     |     |     | 180 |     |     |     |     | 185 |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| gac | gat | aat | aat | aaa | acc | att | gga | gac | tta | gcc | tat | gga | ggg | tca | tgg | 990  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Asp | Asp | Asn | Asn | Lys | Thr | Ile | Gly | Asp | Leu | Ala | Tyr | Gly | Gly | Ser | Trp |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     |     |     |     | 190 |     |     |     |     | 195 |     |     |     |     | 200 |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| tta | ata | ggg | gga | aat | acc | ttt | gaa | gat | gga | cca | gct | ggg | aac | ggg | aca | 1038 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Leu | Ile | Gly | Gly | Asn | Thr | Phe | Glu | Asp | Gly | Pro | Ala | Gly | Asn | Gly | Thr |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     |     | 205 |     |     |     |     |     | 210 |     |     |     |     | 215 |     |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| tta | gaa | tta | aat | ggg | cga | gta | caa | aat | cct | aat | aaa | tat | ggg | cca | cta | 1086 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Leu | Glu | Leu | Asn | Gly | Arg | Val | Gln | Asn | Pro | Asn | Lys | Tyr | Gly | Pro | Leu |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|     |     | 220 |     |     |     |     | 225 |     |     |     |     | 230 |     |     |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

|   |      |
|---|------|
| cct acg gca ggt tca ttc ggg gat agt ggt tct cca atg ttt att tat | 1134 |
| Pro Thr Ala Gly Ser Phe Gly Asp Ser Gly Ser Pro Met Phe Ile Tyr |      |
| 235 240 245   |      |
| gat aag gaa gtt aag aaa tgg tta tta aat ggc gtg tta cgt gaa gga | 1182 |
| Asp Lys Glu Val Lys Lys Trp Leu Leu Asn Gly Val Leu Arg Glu Gly |      |
| 250 255 260 265   |      |
| aat cct tat gct gca gta gga aac agc tat caa att aca cga aaa gat | 1230 |
| Asn Pro Tyr Ala Ala Val Gly Asn Ser Tyr Gln Ile Thr Arg Lys Asp |      |
| 270 275 280   |      |
| tat ttt caa ggt att ctt aat caa gac att aca gct aat ttt tgg gat | 1278 |
| Tyr Phe Gln Gly Ile Leu Asn Gln Asp Ile Thr Ala Asn Phe Trp Asp |      |
| 285 290 295   |      |
| act aat gct gaa tat aga ttt aat ata ggg agt gac cac aat gga aga | 1326 |
| Thr Asn Ala Glu Tyr Arg Phe Asn Ile Gly Ser Asp His Asn Gly Arg |      |
| 300 305 310   |      |
| gtg gca aca atc aaa agt aca tta cct aaa aaa gct att cag cct gaa | 1374 |
| Val Ala Thr Ile Lys Ser Thr Leu Pro Lys Lys Ala Ile Gln Pro Glu |      |
| 315 320 325   |      |
| cga ata gtg ggt ctt tat gat aat agc caa ctt cat gat gct aga gat | 1422 |
| Arg Ile Val Gly Leu Tyr Asp Asn Ser Gln Leu His Asp Ala Arg Asp |      |
| 330 335 340 345   |      |
| aaa aat ggc gat gaa tct ccc tct tat aaa ggt cct aat cca tgg tcg | 1470 |
| Lys Asn Gly Asp Glu Ser Pro Ser Tyr Lys Gly Pro Asn Pro Trp Ser |      |
| 350 355 360   |      |
| cca gca tta cat cat ggg aaa agt att tac ttt ggc gat caa gga aca | 1518 |
| Pro Ala Leu His His Gly Lys Ser Ile Tyr Phe Gly Asp Gln Gly Thr |      |
| 365 370 375   |      |
| gga act tta aca att gaa aat aat ata aat caa ggt gca ggt gga ttg | 1566 |
| Gly Thr Leu Thr Ile Glu Asn Asn Ile Asn Gln Gly Ala Gly Gly Leu |      |
| 380 385 390   |      |
| tat ttt gaa ggt aat ttt gtt gta aaa ggc aat caa aat aat ata act | 1614 |
| Tyr Phe Glu Gly Asn Phe Val Val Lys Gly Asn Gln Asn Asn Ile Thr |      |
| 395 400 405   |      |
| tgg caa ggt gca ggc gtt tct gtt gga gaa gaa agt act gtt gaa tgg | 1662 |
| Trp Gln Gly Ala Gly Val Ser Val Gly Glu Glu Ser Thr Val Glu Trp |      |
| 410 415 420 425   |      |
| cag gtg cat aat cca gaa ggc gat cgc tta tcc aaa att ggg ctg gga | 1710 |
| Gln Val His Asn Pro Glu Gly Asp Arg Leu Ser Lys Ile Gly Leu Gly |      |
| 430 435 440   |      |
| acc tta ctt gtt aat ggt aaa ggg aaa aac tta gga agc ctg agt gtc | 1758 |
| Thr Leu Leu Val Asn Gly Lys Gly Lys Asn Leu Gly Ser Leu Ser Val |      |
| 445 450 455   |      |

|   |      |
|---|------|
| ggc aac ggt ttg gtt gtg tta gat caa caa gca gat gaa tca ggt caa<br>Gly Asn Gly Leu Val Val Leu Asp Gln Gln Ala Asp Glu Ser Gly Gln<br>460 465 470     | 1806 |
| aaa caa gcc ttt aaa gaa gtt ggc att gta agt ggt aga gct acc gtt<br>Lys Gln Ala Phe Lys Glu Val Gly Ile Val Ser Gly Arg Ala Thr Val<br>475 480 485     | 1854 |
| caa cta aat agt gca gat caa gtt gat cct aac aat att tat ttc ggc<br>Gln Leu Asn Ser Ala Asp Gln Val Asp Pro Asn Asn Ile Tyr Phe Gly<br>490 495 500 505 | 1902 |
| ttt cgt ggt ggt cgc tta gat ctt aat ggg cat tca tta acc ttt gaa<br>Phe Arg Gly Gly Arg Leu Asp Leu Asn Gly His Ser Leu Thr Phe Glu<br>510 515 520     | 1950 |
| cgt atc caa aat acg gat gaa ggc gcg atg att gtg aac cac aac gct<br>Arg Ile Gln Asn Thr Asp Glu Gly Ala Met Ile Val Asn His Asn Ala<br>525 530 535     | 1998 |
| tct caa acc gca aat att acg att aca ggc aac gca act att aat tca<br>Ser Gln Thr Ala Asn Ile Thr Ile Thr Gly Asn Ala Thr Ile Asn Ser<br>540 545 550     | 2046 |
| gat agc aaa caa ctt act aat aaa aaa gat att gca ttt aac ggc tgg<br>Asp Ser Lys Gln Leu Thr Asn Lys Lys Asp Ile Ala Phe Asn Gly Trp<br>555 560 565     | 2094 |
| ttt ggt gag caa gat aaa gct aaa aca aat ggt cgt tta aat gtg aat<br>Phe Gly Glu Gln Asp Lys Ala Lys Thr Asn Gly Arg Leu Asn Val Asn<br>570 575 580 585 | 2142 |
| tat caa cca gtt aat gca gaa aat cat ttg ttg ctt tct ggg ggg aca<br>Tyr Gln Pro Val Asn Ala Glu Asn His Leu Leu Leu Ser Gly Gly Thr<br>590 595 600     | 2190 |
| aat tta aac ggc aat atc acg caa aat ggt ggt acg tta gtt ttt agt<br>Asn Leu Asn Gly Asn Ile Thr Gln Asn Gly Gly Thr Leu Val Phe Ser<br>605 610 615     | 2238 |
| ggc cgt cca acg cct cat gct tac aat cat tta aga aga gac ttg tct<br>Gly Arg Pro Thr Pro His Ala Tyr Asn His Leu Arg Arg Asp Leu Ser<br>620 625 630     | 2286 |
| aac atg gaa ggt atc cca caa ggc gaa att gtg tgg gat cac gat tgg<br>Asn Met Glu Gly Ile Pro Gln Gly Glu Ile Val Trp Asp His Asp Trp<br>635 640 645     | 2334 |
| atc aac cgc aca ttt aaa gct gaa aac ttc caa att aaa ggc gga agt<br>Ile Asn Arg Thr Phe Lys Ala Glu Asn Phe Gln Ile Lys Gly Gly Ser<br>650 655 660 665 | 2382 |
| gcg gtg gtt tct cgc aat gtt tct tca att gag gga aat tgg aca gtc<br>Ala Val Val Ser Arg Asn Val Ser Ser Ile Glu Gly Asn Trp Thr Val<br>670 675 680     | 2430 |
| agc aat aat gca aat gcc aca ttt ggt gtt gtg cca aat cag caa aat   | 2478 |

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|--|
| Ser | Asn | Asn | Ala | Asn | Ala | Thr | Phe | Gly | Val | Val | Pro | Asn | Gln | Gln | Asn |      |  |
|     |     |     | 685 |     |     |     |     | 690 |     |     |     |     | 695 |     |     |      |  |
| acc | att | tgc | acg | cgt | tca | gat | tgg | aca | gga | tta | acg | act | tgt | aaa | aca | 2526 |  |
| Thr | Ile | Cys | Thr | Arg | Ser | Asp | Trp | Thr | Gly | Leu | Thr | Thr | Cys | Lys | Thr |      |  |
|     |     | 700 |     |     |     |     | 705 |     |     |     |     | 710 |     |     |     |      |  |
| gtt | gat | tta | acc | gat | aaa | aaa | gtt | att | aat | tcc | ata | ccg | aca | aca | caa | 2574 |  |
| Val | Asp | Leu | Thr | Asp | Lys | Lys | Val | Ile | Asn | Ser | Ile | Pro | Thr | Thr | Gln |      |  |
|     | 715 |     |     |     |     | 720 |     |     |     |     | 725 |     |     |     |     |      |  |
| att | aat | ggg | tct | att | aat | tta | act | gat | aat | gca | aca | gtg | aat | att | cat | 2622 |  |
| Ile | Asn | Gly | Ser | Ile | Asn | Leu | Thr | Asp | Asn | Ala | Thr | Val | Asn | Ile | His |      |  |
| 730 |     |     |     |     | 735 |     |     |     |     | 740 |     |     |     |     | 745 |      |  |
| ggg | tta | gca | aaa | ctt | aat | ggg | aat | gtc | act | tta | ata | gat | cac | agc | caa | 2670 |  |
| Gly | Leu | Ala | Lys | Leu | Asn | Gly | Asn | Val | Thr | Leu | Ile | Asp | His | Ser | Gln |      |  |
|     |     |     | 750 |     |     |     |     | 755 |     |     |     |     | 760 |     |     |      |  |
| ttt | aca | ttg | agc | aac | aat | gcc | acc | caa | gca | ggc | aat | atc | aaa | ctt | tca | 2718 |  |
| Phe | Thr | Leu | Ser | Asn | Asn | Ala | Thr | Gln | Ala | Gly | Asn | Ile | Lys | Leu | Ser |      |  |
|     |     | 765 |     |     |     |     |     | 770 |     |     |     |     | 775 |     |     |      |  |
| aat | cac | gca | aat | gca | acg | gtg | gac | aat | gca | aat | ttg | aac | ggg | aat | gtg | 2766 |  |
| Asn | His | Ala | Asn | Ala | Thr | Val | Asp | Asn | Ala | Asn | Leu | Asn | Gly | Asn | Val |      |  |
|     |     | 780 |     |     |     |     | 785 |     |     |     |     | 790 |     |     |     |      |  |
| aat | tta | atg | gat | tct | gct | caa | ttt | tct | tta | aaa | aac | agc | cat | ttt | tcg | 2814 |  |
| Asn | Leu | Met | Asp | Ser | Ala | Gln | Phe | Ser | Leu | Lys | Asn | Ser | His | Phe | Ser |      |  |
|     | 795 |     |     |     |     | 800 |     |     |     |     | 805 |     |     |     |     |      |  |
| cac | caa | atc | caa | ggg | ggg | gaa | gac | aca | aca | gtg | atg | ttg | gaa | aat | gcg | 2862 |  |
| His | Gln | Ile | Gln | Gly | Gly | Glu | Asp | Thr | Thr | Val | Met | Leu | Glu | Asn | Ala |      |  |
| 810 |     |     |     |     | 815 |     |     |     |     | 820 |     |     |     |     | 825 |      |  |
| act | tgg | aca | atg | cct | agc | gat | acc | aca | ttg | cag | aat | tta | acg | cta | aat | 2910 |  |
| Thr | Trp | Thr | Met | Pro | Ser | Asp | Thr | Thr | Leu | Gln | Asn | Leu | Thr | Leu | Asn |      |  |
|     |     |     |     | 830 |     |     |     |     | 835 |     |     |     |     | 840 |     |      |  |
| aat | agt | act | gtt | acg | tta | aat | tca | gct | tat | tca | gct | atc | tca | aat | aat | 2958 |  |
| Asn | Ser | Thr | Val | Thr | Leu | Asn | Ser | Ala | Tyr | Ser | Ala | Ile | Ser | Asn | Asn |      |  |
|     |     |     | 845 |     |     |     |     | 850 |     |     |     |     | 855 |     |     |      |  |
| gcg | cca | cgc | cgt | cgc | cgc | cgt | tca | tta | gag | acg | gaa | aca | acg | cca | aca | 3006 |  |
| Ala | Pro | Arg | Arg | Arg | Arg | Arg | Ser | Leu | Glu | Thr | Glu | Thr | Thr | Pro | Thr |      |  |
|     |     | 860 |     |     |     |     | 865 |     |     |     |     | 870 |     |     |     |      |  |
| tcg | gca | gaa | cat | cgt | ttc | aac | aca | ttg | aca | gta | aat | ggg | aaa | ttg | agc | 3054 |  |
| Ser | Ala | Glu | His | Arg | Phe | Asn | Thr | Leu | Thr | Val | Asn | Gly | Lys | Leu | Ser |      |  |
|     | 875 |     |     |     |     | 880 |     |     |     |     | 885 |     |     |     |     |      |  |
| ggg | caa | ggc | aca | ttc | caa | ttt | act | tca | tct | tta | ttt | ggc | tat | aaa | agc | 3102 |  |
| Gly | Gln | Gly | Thr | Phe | Gln | Phe | Thr | Ser | Ser | Leu | Phe | Gly | Tyr | Lys | Ser |      |  |
| 890 |     |     |     |     | 895 |     |     |     |     | 900 |     |     |     |     | 905 |      |  |
| gat | aaa | tta | aaa | tta | tcc | aat | gac | gct | gag | ggc | gat | tac | aca | tta | tct | 3150 |  |
| Asp | Lys | Leu | Lys | Leu | Ser | Asn | Asp | Ala | Glu | Gly | Asp | Tyr | Thr | Leu | Ser |      |  |

| 910  |     |     |     |     |      |     |     |     |     | 915  |     |     |     |     | 920  |      |  |  |  |  |
|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|-----|------|------|--|--|--|--|
| gtt  | cgc | aac | aca | ggc | aaa  | gaa | ccc | gtg | acc | ttt  | ggg | caa | tta | act | ttg  | 3198 |  |  |  |  |
| Val  | Arg | Asn | Thr | Gly | Lys  | Glu | Pro | Val | Thr | Phe  | Gly | Gln | Leu | Thr | Leu  |      |  |  |  |  |
| 925  |     |     |     |     | 930  |     |     |     |     | 935  |     |     |     |     |      |      |  |  |  |  |
| gtt  | gaa | agc | aaa | gat | aat  | aaa | ccg | tta | tca | gac  | aaa | ctc | aca | ttc | acg  | 3246 |  |  |  |  |
| Val  | Glu | Ser | Lys | Asp | Asn  | Lys | Pro | Leu | Ser | Asp  | Lys | Leu | Thr | Phe | Thr  |      |  |  |  |  |
| 940  |     |     |     |     | 945  |     |     |     |     | 950  |     |     |     |     |      |      |  |  |  |  |
| tta  | gaa | aat | gac | cac | gtt  | gat | gca | ggg | gca | tta  | cgt | tat | aaa | tta | gtg  | 3294 |  |  |  |  |
| Leu  | Glu | Asn | Asp | His | Val  | Asp | Ala | Gly | Ala | Leu  | Arg | Tyr | Lys | Leu | Val  |      |  |  |  |  |
| 955  |     |     |     |     | 960  |     |     |     |     | 965  |     |     |     |     |      |      |  |  |  |  |
| aag  | aat | gat | ggc | gaa | ttc  | cgc | tta | cat | aac | cca  | ata | aaa | gag | cag | gaa  | 3342 |  |  |  |  |
| Lys  | Asn | Asp | Gly | Glu | Phe  | Arg | Leu | His | Asn | Pro  | Ile | Lys | Glu | Gln | Glu  |      |  |  |  |  |
| 970  |     |     |     |     | 975  |     |     |     |     | 980  |     |     |     |     | 985  |      |  |  |  |  |
| ttg  | cgc | tct | gat | tta | gta  | aga | gca | gag | caa | gca  | gaa | cga | aca | tta | gaa  | 3390 |  |  |  |  |
| Leu  | Arg | Ser | Asp | Leu | Val  | Arg | Ala | Glu | Gln | Ala  | Glu | Arg | Thr | Leu | Glu  |      |  |  |  |  |
| 990  |     |     |     |     | 995  |     |     |     |     | 1000 |     |     |     |     |      |      |  |  |  |  |
| gcc  | aaa | caa | gtt | gaa | cag  | act | gct | aaa | aca | caa  | aca | agt | aag | gca | 3435 |      |  |  |  |  |
| Ala  | Lys | Gln | Val | Glu | Gln  | Thr | Ala | Lys | Thr | Gln  | Thr | Ser | Lys | Ala |      |      |  |  |  |  |
| 1005 |     |     |     |     | 1010 |     |     |     |     | 1015 |     |     |     |     |      |      |  |  |  |  |
| aga  | gtg | cgg | tca | aga | aga  | gcg | gtg | ttt | tct | gat  | ccc | ctg | cct | gct | 3480 |      |  |  |  |  |
| Arg  | Val | Arg | Ser | Arg | Arg  | Ala | Val | Phe | Ser | Asp  | Pro | Leu | Pro | Ala |      |      |  |  |  |  |
| 1020 |     |     |     |     | 1025 |     |     |     |     | 1030 |     |     |     |     |      |      |  |  |  |  |
| caa  | agc | ctg | tta | aac | gca  | tta | gaa | gcc | aaa | caa  | gct | ctg | act | act | 3525 |      |  |  |  |  |
| Gln  | Ser | Leu | Leu | Asn | Ala  | Leu | Glu | Ala | Lys | Gln  | Ala | Leu | Thr | Thr |      |      |  |  |  |  |
| 1035 |     |     |     |     | 1040 |     |     |     |     | 1045 |     |     |     |     |      |      |  |  |  |  |
| gaa  | aca | caa | aca | agt | aag  | gca | aaa | aaa | gtg | cgg  | tca | aaa | aga | gct | 3570 |      |  |  |  |  |
| Glu  | Thr | Gln | Thr | Ser | Lys  | Ala | Lys | Lys | Val | Arg  | Ser | Lys | Arg | Ala |      |      |  |  |  |  |
| 1050 |     |     |     |     | 1055 |     |     |     |     | 1060 |     |     |     |     |      |      |  |  |  |  |
| gcg  | aga | gag | ttt | tct | gat  | acc | ctg | cct | gat | caa  | ata | tta | caa | gcc | 3615 |      |  |  |  |  |
| Ala  | Arg | Glu | Phe | Ser | Asp  | Thr | Leu | Pro | Asp | Gln  | Ile | Leu | Gln | Ala |      |      |  |  |  |  |
| 1065 |     |     |     |     | 1070 |     |     |     |     | 1075 |     |     |     |     |      |      |  |  |  |  |
| gca  | ctt | gag | gtt | att | gat  | gcc | caa | cag | caa | gtg  | aaa | aaa | gaa | cct | 3660 |      |  |  |  |  |
| Ala  | Leu | Glu | Val | Ile | Asp  | Ala | Gln | Gln | Gln | Val  | Lys | Lys | Glu | Pro |      |      |  |  |  |  |
| 1080 |     |     |     |     | 1085 |     |     |     |     | 1090 |     |     |     |     |      |      |  |  |  |  |
| caa  | act | caa | gag | gaa | gaa  | gag | aaa | aga | caa | cgc  | aaa | caa | aaa | gaa | 3705 |      |  |  |  |  |
| Gln  | Thr | Gln | Glu | Glu | Glu  | Glu | Lys | Arg | Gln | Arg  | Lys | Gln | Lys | Glu |      |      |  |  |  |  |
| 1095 |     |     |     |     | 1100 |     |     |     |     | 1105 |     |     |     |     |      |      |  |  |  |  |
| ttg  | atc | agc | cgt | tac | tca  | aat | agt | gcg | tta | tcg  | gag | ttg | tct | gcg | 3750 |      |  |  |  |  |
| Leu  | Ile | Ser | Arg | Tyr | Ser  | Asn | Ser | Ala | Leu | Ser  | Glu | Leu | Ser | Ala |      |      |  |  |  |  |
| 1110 |     |     |     |     | 1115 |     |     |     |     | 1120 |     |     |     |     |      |      |  |  |  |  |
| aca  | gta | aat | agt | atg | ctt  | tcc | gtt | caa | gat | gaa  | ttg | gat | cgt | ctt | 3795 |      |  |  |  |  |
| Thr  | Val | Asn | Ser | Met | Leu  | Ser | Val | Gln | Asp | Glu  | Leu | Asp | Arg | Leu |      |      |  |  |  |  |
| 1125 |     |     |     |     | 1130 |     |     |     |     | 1135 |     |     |     |     |      |      |  |  |  |  |



|   |      |
|---|------|
| ttt gta gat caa gca caa tct gcc gtg tgg aca aat atc gca cag | 3840 |
| Phe Val Asp Gln Ala Gln Ser Ala Val Trp Thr Asn Ile Ala Gln |      |
| 1140 1145 1150  |      |
| gat aaa aga cgc tat gat tct gat gcg ttc cgt gct tat cag cag | 3885 |
| Asp Lys Arg Arg Tyr Asp Ser Asp Ala Phe Arg Ala Tyr Gln Gln |      |
| 1155 1160 1165  |      |
| aaa acg aac ttg cgt caa att ggg gtg caa aaa gcc tta gat aat | 3930 |
| Lys Thr Asn Leu Arg Gln Ile Gly Val Gln Lys Ala Leu Asp Asn |      |
| 1170 1175 1180  |      |
| gga cga att ggg gcg gtt ttc tcg cat agc cgt tca gat aat acc | 3975 |
| Gly Arg Ile Gly Ala Val Phe Ser His Ser Arg Ser Asp Asn Thr |      |
| 1185 1190 1195  |      |
| ttt gac gaa cag gtt aaa aat cac gcg aca tta gcg atg atg tct | 4020 |
| Phe Asp Glu Gln Val Lys Asn His Ala Thr Leu Ala Met Met Ser |      |
| 1200 1205 1210  |      |
| ggg ttt gcc caa tat caa tgg ggc gat tta caa ttt ggt gta aac | 4065 |
| Gly Phe Ala Gln Tyr Gln Trp Gly Asp Leu Gln Phe Gly Val Asn |      |
| 1215 1220 1225  |      |
| gtg ggt gcg gga att agt gcg agt aaa atg gct gaa gaa caa agc | 4110 |
| Val Gly Ala Gly Ile Ser Ala Ser Lys Met Ala Glu Glu Gln Ser |      |
| 1230 1235 1240  |      |
| cga aaa att cat cga aaa gcg ata aat tat ggt gtg aat gca agt | 4155 |
| Arg Lys Ile His Arg Lys Ala Ile Asn Tyr Gly Val Asn Ala Ser |      |
| 1245 1250 1255  |      |
| tat cag ttc cgt tta ggg caa ttg ggt att cag cct tat ttg ggt | 4200 |
| Tyr Gln Phe Arg Leu Gly Gln Leu Gly Ile Gln Pro Tyr Leu Gly |      |
| 1260 1265 1270  |      |
| gtt aat cga tat ttt att gaa cgt gaa aat tat caa tct gaa gaa | 4245 |
| Val Asn Arg Tyr Phe Ile Glu Arg Glu Asn Tyr Gln Ser Glu Glu |      |
| 1275 1280 1285  |      |
| gtg aaa gtg caa aca ccg agc ctt gta ttt aat cgc tat aat gct | 4290 |
| Val Lys Val Gln Thr Pro Ser Leu Val Phe Asn Arg Tyr Asn Ala |      |
| 1290 1295 1300  |      |
| ggc att cga gtt gat tat aca ttt acc ccg aca gat aat atc agc | 4335 |
| Gly Ile Arg Val Asp Tyr Thr Phe Thr Pro Thr Asp Asn Ile Ser |      |
| 1305 1310 1315  |      |
| att aag cct tat ttc ttc gtc aat tat gtt gat gtt tca aac gct | 4380 |
| Ile Lys Pro Tyr Phe Phe Val Asn Tyr Val Asp Val Ser Asn Ala |      |
| 1320 1325 1330  |      |
| aac gta caa acc act gta aat cgc acg atg ttg caa caa tca ttt | 4425 |
| Asn Val Gln Thr Thr Val Asn Arg Thr Met Leu Gln Gln Ser Phe |      |
| 1335 1340 1345  |      |

|                 |                     |                     |     |      |
|-----------------|---------------------|---------------------|-----|------|
| ggg cgt tat tgg | caa aaa gaa gtg gga | tta aag gca gaa att | tta | 4470 |
| Gly Arg Tyr Trp | Gln Lys Glu Val Gly | Leu Lys Ala Glu Ile | Leu |      |
| 1350            | 1355                | 1360                |     |      |

|                 |                     |                     |     |      |
|-----------------|---------------------|---------------------|-----|------|
| cat ttc caa ctt | tcc gct ttt atc tca | aaa tct caa ggt tca | caa | 4515 |
| His Phe Gln Leu | Ser Ala Phe Ile Ser | Lys Ser Gln Gly Ser | Gln |      |
| 1365            | 1370                | 1375                |     |      |

|                 |                     |                     |     |      |
|-----------------|---------------------|---------------------|-----|------|
| ctc ggc aaa cag | caa aat gtg ggc gtg | aaa ttg ggg tat cgt | tgg | 4560 |
| Leu Gly Lys Gln | Gln Asn Val Gly Val | Lys Leu Gly Tyr Arg | Trp |      |
| 1380            | 1385                | 1390                |     |      |

|                          |                       |            |      |
|--------------------------|-----------------------|------------|------|
| tta aatcaacat aattttatcg | tttattgata aacaaggtgg | ggcagatcaa | 4613 |
|--------------------------|-----------------------|------------|------|

|                       |                       |                       |      |
|-----------------------|-----------------------|-----------------------|------|
| atcctacctt ttttattcca | ataatggaac tttattttat | taaaggtatc taagtagcac | 4673 |
|-----------------------|-----------------------|-----------------------|------|

|                       |                       |                      |      |
|-----------------------|-----------------------|----------------------|------|
| cctatatagg gattaattaa | gaggatttaa taatgaattt | aactaaaatt ttaccacat | 4733 |
|-----------------------|-----------------------|----------------------|------|

|                       |                        |                       |      |
|-----------------------|------------------------|-----------------------|------|
| ttgctgctgt agtcgtatta | tctgcttggtg caaaggatgc | acctgaaatg acaaaatcat | 4793 |
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<400> 15

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| Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr Phe Gly Ile |
| 20 25 30  |

|   |
|---|
| Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe Thr |
| 35 40 45  |

|   |
|---|
| Val Gly Ala Gln Asp Ile Asp Ile Tyr Asn Lys Lys Gly Glu Met Ile |
| 50 55 60  |

|   |
|---|
| Gly Thr Met Met Lys Gly Val Pro Met Pro Asp Leu Ser Ser Met Val |
| 65 70 75 80   |

|   |
|---|
| Arg Gly Gly Tyr Ser Thr Leu Ile Ser Glu Gln His Leu Ile Ser Val |
| 85 90 95  |

|   |
|---|
| Ala His Asn Val Gly Tyr Asp Val Val Asp Phe Gly Met Glu Gly Glu |
| 100 105 110   |

Asn Pro Asp Gln His Arg Phe Lys Tyr Lys Val Val Lys Arg Tyr Asn  
 115 120 125

Tyr Lys Ser Gly Asp Arg Gln Tyr Asn Asp Tyr Gln His Pro Arg Leu  
 130 135 140

Glu Lys Phe Val Thr Glu Thr Ala Pro Ile Glu Met Val Ser Tyr Met  
 145 150 155 160

Asp Gly Asn His Tyr Lys Asn Phe Asn Gln Tyr Pro Leu Arg Val Arg  
 165 170 175

Val Gly Ser Gly His Gln Trp Trp Lys Asp Asp Asn Asn Lys Thr Ile  
 180 185 190

Gly Asp Leu Ala Tyr Gly Gly Ser Trp Leu Ile Gly Gly Asn Thr Phe  
 195 200 205

Glu Asp Gly Pro Ala Gly Asn Gly Thr Leu Glu Leu Asn Gly Arg Val  
 210 215 220

Gln Asn Pro Asn Lys Tyr Gly Pro Leu Pro Thr Ala Gly Ser Phe Gly  
 225 230 235 240

Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp Lys Glu Val Lys Lys Trp  
 245 250 255

Leu Leu Asn Gly Val Leu Arg Glu Gly Asn Pro Tyr Ala Ala Val Gly  
 260 265 270

Asn Ser Tyr Gln Ile Thr Arg Lys Asp Tyr Phe Gln Gly Ile Leu Asn  
 275 280 285

Gln Asp Ile Thr Ala Asn Phe Trp Asp Thr Asn Ala Glu Tyr Arg Phe  
 290 295 300

Asn Ile Gly Ser Asp His Asn Gly Arg Val Ala Thr Ile Lys Ser Thr  
 305 310 315 320

Leu Pro Lys Lys Ala Ile Gln Pro Glu Arg Ile Val Gly Leu Tyr Asp  
 325 330 335

Asn Ser Gln Leu His Asp Ala Arg Asp Lys Asn Gly Asp Glu Ser Pro  
 340 345 350

Ser Tyr Lys Gly Pro Asn Pro Trp Ser Pro Ala Leu His His Gly Lys  
 355 360 365

Ser Ile Tyr Phe Gly Asp Gln Gly Thr Gly Thr Leu Thr Ile Glu Asn  
 370 375 380

Asn Ile Asn Gln Gly Ala Gly Gly Leu Tyr Phe Glu Gly Asn Phe Val  
 385 390 395 400

Val Lys Gly Asn Gln Asn Asn Ile Thr Trp Gln Gly Ala Gly Val Ser  
 405 410 415

Val Gly Glu Glu Ser Thr Val Glu Trp Gln Val His Asn Pro Glu Gly  
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Asp Arg Leu Ser Lys Ile Gly Leu Gly Thr Leu Leu Val Asn Gly Lys  
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Gly Lys Asn Leu Gly Ser Leu Ser Val Gly Asn Gly Leu Val Val Leu  
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Asp Gln Gln Ala Asp Glu Ser Gly Gln Lys Gln Ala Phe Lys Glu Val  
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Gly Ile Val Ser Gly Arg Ala Thr Val Gln Leu Asn Ser Ala Asp Gln  
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Val Asp Pro Asn Asn Ile Tyr Phe Gly Phe Arg Gly Gly Arg Leu Asp  
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Leu Asn Gly His Ser Leu Thr Phe Glu Arg Ile Gln Asn Thr Asp Glu  
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Gly Ala Met Ile Val Asn His Asn Ala Ser Gln Thr Ala Asn Ile Thr  
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Ile Thr Gly Asn Ala Thr Ile Asn Ser Asp Ser Lys Gln Leu Thr Asn  
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Lys Lys Asp Ile Ala Phe Asn Gly Trp Phe Gly Glu Gln Asp Lys Ala

565

570

575

Lys Thr Asn Gly Arg Leu Asn Val Asn Tyr Gln Pro Val Asn Ala Glu  
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Asn His Leu Leu Leu Ser Gly Gly Thr Asn Leu Asn Gly Asn Ile Thr  
595 600 605

Gln Asn Gly Gly Thr Leu Val Phe Ser Gly Arg Pro Thr Pro His Ala  
610 615 620

Tyr Asn His Leu Arg Arg Asp Leu Ser Asn Met Glu Gly Ile Pro Gln  
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Gly Glu Ile Val Trp Asp His Asp Trp Ile Asn Arg Thr Phe Lys Ala  
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Glu Asn Phe Gln Ile Lys Gly Gly Ser Ala Val Val Ser Arg Asn Val  
660 665 670

Ser Ser Ile Glu Gly Asn Trp Thr Val Ser Asn Asn Ala Asn Ala Thr  
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Phe Gly Val Val Pro Asn Gln Gln Asn Thr Ile Cys Thr Arg Ser Asp  
690 695 700

Trp Thr Gly Leu Thr Thr Cys Lys Thr Val Asp Leu Thr Asp Lys Lys  
705 710 715 720

Val Ile Asn Ser Ile Pro Thr Thr Gln Ile Asn Gly Ser Ile Asn Leu  
725 730 735

Thr Asp Asn Ala Thr Val Asn Ile His Gly Leu Ala Lys Leu Asn Gly  
740 745 750

Asn Val Thr Leu Ile Asp His Ser Gln Phe Thr Leu Ser Asn Asn Ala  
755 760 765

Thr Gln Ala Gly Asn Ile Lys Leu Ser Asn His Ala Asn Ala Thr Val  
770 775 780

Asp Asn Ala Asn Leu Asn Gly Asn Val Asn Leu Met Asp Ser Ala Gln  
785 790 795 800

Phe Ser Leu Lys Asn Ser His Phe Ser His Gln Ile Gln Gly Gly Glu  
805 810 815

Asp Thr Thr Val Met Leu Glu Asn Ala Thr Trp Thr Met Pro Ser Asp  
820 825 830

Thr Thr Leu Gln Asn Leu Thr Leu Asn Asn Ser Thr Val Thr Leu Asn  
835 840 845

Ser Ala Tyr Ser Ala Ile Ser Asn Asn Ala Pro Arg Arg Arg Arg Arg  
850 855 860

Ser Leu Glu Thr Glu Thr Thr Pro Thr Ser Ala Glu His Arg Phe Asn  
865 870 875 880

Thr Leu Thr Val Asn Gly Lys Leu Ser Gly Gln Gly Thr Phe Gln Phe  
885 890 895

Thr Ser Ser Leu Phe Gly Tyr Lys Ser Asp Lys Leu Lys Leu Ser Asn  
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Asp Ala Glu Gly Asp Tyr Thr Leu Ser Val Arg Asn Thr Gly Lys Glu  
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Pro Val Thr Phe Gly Gln Leu Thr Leu Val Glu Ser Lys Asp Asn Lys  
930 935 940

Pro Leu Ser Asp Lys Leu Thr Phe Thr Leu Glu Asn Asp His Val Asp  
945 950 955 960

Ala Gly Ala Leu Arg Tyr Lys Leu Val Lys Asn Asp Gly Glu Phe Arg  
965 970 975

Leu His Asn Pro Ile Lys Glu Gln Glu Leu Arg Ser Asp Leu Val Arg  
980 985 990

Ala Glu Gln Ala Glu Arg Thr Leu Glu Ala Lys Gln Val Glu Gln Thr  
995 1000 1005

Ala Lys Thr Gln Thr Ser Lys Ala Arg Val Arg Ser Arg Arg Ala  
1010 1015 1020

|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|
| Val  | Phe | Ser | Asp | Pro | Leu | Pro  | Ala | Gln | Ser | Leu | Leu  | Asn | Ala | Leu |
| 1025 |     |     |     |     |     | 1030 |     |     |     |     | 1035 |     |     |     |
| Glu  | Ala | Lys | Gln | Ala | Leu | Thr  | Thr | Glu | Thr | Gln | Thr  | Ser | Lys | Ala |
| 1040 |     |     |     |     |     | 1045 |     |     |     |     | 1050 |     |     |     |
| Lys  | Lys | Val | Arg | Ser | Lys | Arg  | Ala | Ala | Arg | Glu | Phe  | Ser | Asp | Thr |
| 1055 |     |     |     |     |     | 1060 |     |     |     |     | 1065 |     |     |     |
| Leu  | Pro | Asp | Gln | Ile | Leu | Gln  | Ala | Ala | Leu | Glu | Val  | Ile | Asp | Ala |
| 1070 |     |     |     |     |     | 1075 |     |     |     |     | 1080 |     |     |     |
| Gln  | Gln | Gln | Val | Lys | Lys | Glu  | Pro | Gln | Thr | Gln | Glu  | Glu | Glu | Glu |
| 1085 |     |     |     |     |     | 1090 |     |     |     |     | 1095 |     |     |     |
| Lys  | Arg | Gln | Arg | Lys | Gln | Lys  | Glu | Leu | Ile | Ser | Arg  | Tyr | Ser | Asn |
| 1100 |     |     |     |     |     | 1105 |     |     |     |     | 1110 |     |     |     |
| Ser  | Ala | Leu | Ser | Glu | Leu | Ser  | Ala | Thr | Val | Asn | Ser  | Met | Leu | Ser |
| 1115 |     |     |     |     |     | 1120 |     |     |     |     | 1125 |     |     |     |
| Val  | Gln | Asp | Glu | Leu | Asp | Arg  | Leu | Phe | Val | Asp | Gln  | Ala | Gln | Ser |
| 1130 |     |     |     |     |     | 1135 |     |     |     |     | 1140 |     |     |     |
| Ala  | Val | Trp | Thr | Asn | Ile | Ala  | Gln | Asp | Lys | Arg | Arg  | Tyr | Asp | Ser |
| 1145 |     |     |     |     |     | 1150 |     |     |     |     | 1155 |     |     |     |
| Asp  | Ala | Phe | Arg | Ala | Tyr | Gln  | Gln | Lys | Thr | Asn | Leu  | Arg | Gln | Ile |
| 1160 |     |     |     |     |     | 1165 |     |     |     |     | 1170 |     |     |     |
| Gly  | Val | Gln | Lys | Ala | Leu | Asp  | Asn | Gly | Arg | Ile | Gly  | Ala | Val | Phe |
| 1175 |     |     |     |     |     | 1180 |     |     |     |     | 1185 |     |     |     |
| Ser  | His | Ser | Arg | Ser | Asp | Asn  | Thr | Phe | Asp | Glu | Gln  | Val | Lys | Asn |
| 1190 |     |     |     |     |     | 1195 |     |     |     |     | 1200 |     |     |     |
| His  | Ala | Thr | Leu | Ala | Met | Met  | Ser | Gly | Phe | Ala | Gln  | Tyr | Gln | Trp |
| 1205 |     |     |     |     |     | 1210 |     |     |     |     | 1215 |     |     |     |
| Gly  | Asp | Leu | Gln | Phe | Gly | Val  | Asn | Val | Gly | Ala | Gly  | Ile | Ser | Ala |
| 1220 |     |     |     |     |     | 1225 |     |     |     |     | 1230 |     |     |     |

Ser Lys Met Ala Glu Glu Gln Ser Arg Lys Ile His Arg Lys Ala  
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Ile Asn Tyr Gly Val Asn Ala Ser Tyr Gln Phe Arg Leu Gly Gln  
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Leu Gly Ile Gln Pro Tyr Leu Gly Val Asn Arg Tyr Phe Ile Glu  
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Arg Glu Asn Tyr Gln Ser Glu Glu Val Lys Val Gln Thr Pro Ser  
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Leu Val Phe Asn Arg Tyr Asn Ala Gly Ile Arg Val Asp Tyr Thr  
 1295 1300 1305

Phe Thr Pro Thr Asp Asn Ile Ser Ile Lys Pro Tyr Phe Phe Val  
 1310 1315 1320

Asn Tyr Val Asp Val Ser Asn Ala Asn Val Gln Thr Thr Val Asn  
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Arg Thr Met Leu Gln Gln Ser Phe Gly Arg Tyr Trp Gln Lys Glu  
 1340 1345 1350

Val Gly Leu Lys Ala Glu Ile Leu His Phe Gln Leu Ser Ala Phe  
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| ttatttttctt ttgtgccttt tagttcgttt ttttagctga aatcccttag aaaatcaccg | 240 |
| cactttttatt gttcaatagt cgtttaacca cgtatttttt aatacgaaaa attacttaat | 300 |
| taaataaaca tt atg aaa aaa act gta ttt cgt ctg aat ttt tta acc gct  | 351 |
| Met Lys Lys Thr Val Phe Arg Leu Asn Phe Leu Thr Ala                |     |
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| Cys Ile Ser Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr    |     |
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| ttt ggg att gac tac caa tat tat cgt gat ttt gcc gag aat aaa ggg    | 447 |
| Phe Gly Ile Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly    |     |
| 30 35 40 45  |     |
| aag ttc aca gtt ggg gct aaa aat att gag gtt tac aat aaa aat gga    | 495 |
| Lys Phe Thr Val Gly Ala Lys Asn Ile Glu Val Tyr Asn Lys Asn Gly    |     |
| 50 55 60   |     |
| aat tta gtt ggc aca tca atg aca aaa gcc cca atg att gat ttt tcc    | 543 |
| Asn Leu Val Gly Thr Ser Met Thr Lys Ala Pro Met Ile Asp Phe Ser    |     |
| 65 70 75   |     |
| gtg gtg tgc cga aat ggg gtg gcg gca ttg gtg ggc gat cag tat att    | 591 |
| Val Val Ser Arg Asn Gly Val Ala Ala Leu Val Gly Asp Gln Tyr Ile    |     |
| 80 85 90   |     |
| gtg agt gtg gca cat aat gta ggc tat acc aat gtg gat ttt ggt gct    | 639 |
| Val Ser Val Ala His Asn Val Gly Tyr Thr Asn Val Asp Phe Gly Ala    |     |
| 95 100 105   |     |
| gaa gga caa aat cct gat caa cat cgt ttt act tat aaa att gtg aaa    | 687 |
| Glu Gly Gln Asn Pro Asp Gln His Arg Phe Thr Tyr Lys Ile Val Lys    |     |
| 110 115 120 125  |     |
| cgg aat aat tat aaa aac gat caa acg cat cct tat gag aaa gac tac    | 735 |
| Arg Asn Asn Tyr Lys Asn Asp Gln Thr His Pro Tyr Glu Lys Asp Tyr    |     |
| 130 135 140  |     |
| cac aac cca cgc tta cat aaa ttt gtt acg gaa gcc acc cca atc gat    | 783 |
| His Asn Pro Arg Leu His Lys Phe Val Thr Glu Ala Thr Pro Ile Asp    |     |
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| atg act tct gat atg aac ggc aac aaa tat aca gat agg acg aaa tat    | 831 |
| Met Thr Ser Asp Met Asn Gly Asn Lys Tyr Thr Asp Arg Thr Lys Tyr    |     |
| 160 165 170  |     |
| ccc gaa cgc gtg cgt atc ggc tcc ggg tgg cag ttt tgg cga aac gat    | 879 |
| Pro Glu Arg Val Arg Ile Gly Ser Gly Trp Gln Phe Trp Arg Asn Asp    |     |
| 175 180 185  |     |

|   |      |
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| ggc aat aca cac aac caa ggc gga gca ggg ggc ggc tgg tca agt ctg<br>Gly Asn Thr His Asn Gln Gly Gly Ala Gly Gly Gly Trp Ser Ser Leu<br>210 215 220     | 975  |
| agc ggc gat gtg cgc caa gcg ggc aat tac ggc ccc att cct att gca<br>Ser Gly Asp Val Arg Gln Ala Gly Asn Tyr Gly Pro Ile Pro Ile Ala<br>225 230 235     | 1023 |
| ggc tca agc ggc gac agc ggt tcg cct atg ttt att tat gat gcg gaa<br>Gly Ser Ser Gly Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp Ala Glu<br>240 245 250     | 1071 |
| aaa caa aaa tgg ttg att aac ggc gta ttg agg acc ggc aac cct tgg<br>Lys Gln Lys Trp Leu Ile Asn Gly Val Leu Arg Thr Gly Asn Pro Trp<br>255 260 265     | 1119 |
| gcg ggg aca gag aat aca ttc caa ctg gta cgc aag tct ttt ttt gat<br>Ala Gly Thr Glu Asn Thr Phe Gln Leu Val Arg Lys Ser Phe Phe Asp<br>270 275 280 285 | 1167 |
| gaa atc ctt gaa aaa gat ttg cgt aca tcg ttt tat agc cca tcg ggc<br>Glu Ile Leu Glu Lys Asp Leu Arg Thr Ser Phe Tyr Ser Pro Ser Gly<br>290 295 300     | 1215 |
| aat ggt gca tac acc att aca gac aaa ggc gac ggc agc ggc att gtc<br>Asn Gly Ala Tyr Thr Ile Thr Asp Lys Gly Asp Gly Ser Gly Ile Val<br>305 310 315     | 1263 |
| aaa caa caa aca gga aga cca tct gaa gtc cgc atc ggt tta aaa gac<br>Lys Gln Gln Thr Gly Arg Pro Ser Glu Val Arg Ile Gly Leu Lys Asp<br>320 325 330     | 1311 |
| gac aaa tta cct gcc gaa ggt aaa gac gat gtt tac caa tac caa ggt<br>Asp Lys Leu Pro Ala Glu Gly Lys Asp Asp Val Tyr Gln Tyr Gln Gly<br>335 340 345     | 1359 |
| cca aat ata tac ctg cct cgt ttg aat aac ggt gga aac ctg tat ttc<br>Pro Asn Ile Tyr Leu Pro Arg Leu Asn Asn Gly Gly Asn Leu Tyr Phe<br>350 355 360 365 | 1407 |
| gga gat caa aaa aac ggc act gtt acc tta tca acc aac atc aac caa<br>Gly Asp Gln Lys Asn Gly Thr Val Thr Leu Ser Thr Asn Ile Asn Gln<br>370 375 380     | 1455 |
| ggt gcg ggc ggt ttg tat ttt gag ggt aac ttt acg gta tct tca gaa<br>Gly Ala Gly Gly Leu Tyr Phe Glu Gly Asn Phe Thr Val Ser Ser Glu<br>385 390 395     | 1503 |
| aat aat gca act tgg caa ggt gct gga gtg cat gta ggt gaa gac agt<br>Asn Asn Ala Thr Trp Gln Gly Ala Gly Val His Val Gly Glu Asp Ser<br>400 405 410     | 1551 |
| act gtt act tgg aaa gta aat ggt gtt gaa aat gat cgc ctt tct aaa   | 1599 |

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|---|------|
| Thr Val Thr Trp Lys Val Asn Gly Val Glu Asn Asp Arg Leu Ser Lys |      |
| 415 420 425   |      |
| atc ggc aaa ggc aca ttg cac gtt aaa gcc aaa ggg gaa aat aaa ggt | 1647 |
| Ile Gly Lys Gly Thr Leu His Val Lys Ala Lys Gly Glu Asn Lys Gly |      |
| 430 435 440 445   |      |
| tcg atc agc gta ggc gat ggt aaa gtc att ttg gag cag cag gca gac | 1695 |
| Ser Ile Ser Val Gly Asp Gly Lys Val Ile Leu Glu Gln Gln Ala Asp |      |
| 450 455 460   |      |
| gat caa ggc aac aaa caa gcc ttt agt gaa att ggc ttg gtt agt ggc | 1743 |
| Asp Gln Gly Asn Lys Gln Ala Phe Ser Glu Ile Gly Leu Val Ser Gly |      |
| 465 470 475   |      |
| aga ggt acg gtt cag tta aac gat gac aag caa ttt aat act gat aaa | 1791 |
| Arg Gly Thr Val Gln Leu Asn Asp Lys Gln Phe Asn Thr Asp Lys     |      |
| 480 485 490   |      |
| ttt tat ttc ggc ttc cgt ggt ggt cgc tta gat ctt aat ggg cat tca | 1839 |
| Phe Tyr Phe Gly Phe Arg Gly Gly Arg Leu Asp Leu Asn Gly His Ser |      |
| 495 500 505   |      |
| tta acc ttt aaa cgt atc caa aat acg gat gag gga gca acg att gtt | 1887 |
| Leu Thr Phe Lys Arg Ile Gln Asn Thr Asp Glu Gly Ala Thr Ile Val |      |
| 510 515 520 525   |      |
| aat cac aat gcc aca aca gaa tct aca gtg acc att act ggc agc gat | 1935 |
| Asn His Asn Ala Thr Thr Glu Ser Thr Val Thr Ile Thr Gly Ser Asp |      |
| 530 535 540   |      |
| acc att aat gac aac act ggc gat tta acc aat aaa cgt gat att gct | 1983 |
| Thr Ile Asn Asp Asn Thr Gly Asp Leu Thr Asn Lys Arg Asp Ile Ala |      |
| 545 550 555   |      |
| ttt aat ggt tgg ttt ggt gat aaa gat gat act aaa aat act gga cgt | 2031 |
| Phe Asn Gly Trp Phe Gly Asp Lys Asp Asp Thr Lys Asn Thr Gly Arg |      |
| 560 565 570   |      |
| ttg aat gtt act tac aat ccg ctt aac aaa gat aat cac ttc ctt cta | 2079 |
| Leu Asn Val Thr Tyr Asn Pro Leu Asn Lys Asp Asn His Phe Leu Leu |      |
| 575 580 585   |      |
| tca ggt gga aca aat tta aaa ggc aat att act caa gac ggt ggc act | 2127 |
| Ser Gly Gly Thr Asn Leu Lys Gly Asn Ile Thr Gln Asp Gly Gly Thr |      |
| 590 595 600 605   |      |
| tta gtg ttt agt ggt cgc cca aca cca cac gca tac aat cat tta aat | 2175 |
| Leu Val Phe Ser Gly Arg Pro Thr Pro His Ala Tyr Asn His Leu Asn |      |
| 610 615 620   |      |
| cgc cta aac gag ctt ggg cga cct aag ggc gaa gtg gtt att gat gac | 2223 |
| Arg Leu Asn Glu Leu Gly Arg Pro Lys Gly Glu Val Val Ile Asp Asp |      |
| 625 630 635   |      |
| gat tgg atc aac cgt aca ttt aaa gct gaa aac ttc caa att aaa ggc | 2271 |
| Asp Trp Ile Asn Arg Thr Phe Lys Ala Glu Asn Phe Gln Ile Lys Gly |      |

| 640   | 645 | 650 |      |
|---|-----|-----|------|
| gga agt acg gtg gtt tct cgc aat gtt tct tca att gaa gga aat tgg<br>Gly Ser Thr Val Val Ser Arg Asn Val Ser Ser Ile Glu Gly Asn Trp<br>655 660 665     |     |     | 2319 |
| aca atc agc aat aac gcc aac gcg aca ttt ggt gtt gtg cca aat caa<br>Thr Ile Ser Asn Asn Ala Asn Ala Thr Phe Gly Val Val Pro Asn Gln<br>670 675 680 685 |     |     | 2367 |
| caa aat acc att tgc acg cgt tca gat tgg aca gga tta acg act tgt<br>Gln Asn Thr Ile Cys Thr Arg Ser Asp Trp Thr Gly Leu Thr Thr Cys<br>690 695 700     |     |     | 2415 |
| aaa aca gtt aat tta acc gat aaa aaa gtt att gat tcc ata ccg aca<br>Lys Thr Val Asn Leu Thr Asp Lys Lys Val Ile Asp Ser Ile Pro Thr<br>705 710 715     |     |     | 2463 |
| aca caa att aat ggc tct att aat tta act aat aat gca aca gtg aat<br>Thr Gln Ile Asn Gly Ser Ile Asn Leu Thr Asn Asn Ala Thr Val Asn<br>720 725 730     |     |     | 2511 |
| att cat ggt tta gca aaa ctt aat ggt aat gtc act tta ata aat cat<br>Ile His Gly Leu Ala Lys Leu Asn Gly Asn Val Thr Leu Ile Asn His<br>735 740 745     |     |     | 2559 |
| agc caa ttt aca ttg agc aac aat gcc acc caa aca ggc aat atc caa<br>Ser Gln Phe Thr Leu Ser Asn Asn Ala Thr Gln Thr Gly Asn Ile Gln<br>750 755 760 765 |     |     | 2607 |
| ctt tca aat cac gca aat gca acg gtg gat aat gca aac ttg aac ggt<br>Leu Ser Asn His Ala Asn Ala Thr Val Asp Asn Ala Asn Leu Asn Gly<br>770 775 780     |     |     | 2655 |
| aat gtg cat tta acg gat tct gct caa ttt tct tta aaa aac agc cat<br>Asn Val His Leu Thr Asp Ser Ala Gln Phe Ser Leu Lys Asn Ser His<br>785 790 795     |     |     | 2703 |
| ttt tcg cac caa att cag ggc gac aaa gac aca aca gtg acg ttg gaa<br>Phe Ser His Gln Ile Gln Gly Asp Lys Asp Thr Thr Val Thr Leu Glu<br>800 805 810     |     |     | 2751 |
| aat gcg act tgg aca atg cct agc gat act aca ttg cag aat tta acg<br>Asn Ala Thr Trp Thr Met Pro Ser Asp Thr Thr Leu Gln Asn Leu Thr<br>815 820 825     |     |     | 2799 |
| cta aat aat agt act gtt acg tta aat tca gct tat tca gct agc tca<br>Leu Asn Asn Ser Thr Val Thr Leu Asn Ser Ala Tyr Ser Ala Ser Ser<br>830 835 840 845 |     |     | 2847 |
| aat aat gcg cca cgt cac cgc cgt tca tta gag acg gaa aca acg cca<br>Asn Asn Ala Pro Arg His Arg Arg Ser Leu Glu Thr Glu Thr Thr Pro<br>850 855 860     |     |     | 2895 |
| aca tcg gaa gaa cat cgt ttc aac aca ttg aca gta aat ggt aaa ttg<br>Thr Ser Glu Glu His Arg Phe Asn Thr Leu Thr Val Asn Gly Lys Leu<br>865 870 875     |     |     | 2943 |

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|---|------|
| agc ggg caa ggc aca ttc caa ttt act tca tct tta ttt ggc tat aaa | 2991 |
| Ser Gly Gln Gly Thr Phe Gln Phe Thr Ser Ser Leu Phe Gly Tyr Lys |      |
| 880 885 890   |      |
| agc gat aaa ata aaa tta tct aat gac gct gaa ggc gat tac aca tta | 3039 |
| Ser Asp Lys Ile Lys Leu Ser Asn Asp Ala Glu Gly Asp Tyr Thr Leu |      |
| 895 900 905   |      |
| gct gtt cgc gac aca ggc aaa gaa cct gtg acc ctt gag caa tta act | 3087 |
| Ala Val Arg Asp Thr Gly Lys Glu Pro Val Thr Leu Glu Gln Leu Thr |      |
| 910 915 920 925   |      |
| tta att gaa ggc ttg gat aat caa ccc ttg cca gat aag cta aaa att | 3135 |
| Leu Ile Glu Gly Leu Asp Asn Gln Pro Leu Pro Asp Lys Leu Lys Ile |      |
| 930 935 940   |      |
| act tta aaa aat aaa cac gtt gat gcg ggt gca tgg cgt tat gaa tta | 3183 |
| Thr Leu Lys Asn Lys His Val Asp Ala Gly Ala Trp Arg Tyr Glu Leu |      |
| 945 950 955   |      |
| gtg aag aaa aac ggc gaa ttc cgc ttg cat aat cca ata aaa gag cag | 3231 |
| Val Lys Lys Asn Gly Glu Phe Arg Leu His Asn Pro Ile Lys Glu Gln |      |
| 960 965 970   |      |
| gaa ttg cgc aat gat tta gta aaa gca gag caa gta gaa cga gca tta | 3279 |
| Glu Leu Arg Asn Asp Leu Val Lys Ala Glu Gln Val Glu Arg Ala Leu |      |
| 975 980 985   |      |
| gaa gca aaa caa gct gaa ctg act act aaa aaa caa aaa act gag gct | 3327 |
| Glu Ala Lys Gln Ala Glu Leu Thr Thr Lys Lys Gln Lys Thr Glu Ala |      |
| 990 995 1000 1005   |      |
| aaa gtg cgg tca aaa aga gcg gcg ttt tct gat acc ccg cct gat     | 3372 |
| Lys Val Arg Ser Lys Arg Ala Ala Phe Ser Asp Thr Pro Pro Asp     |      |
| 1010 1015 1020  |      |
| caa agc cag tta aac gca tta caa gcc gaa ctc gag acg att aat     | 3417 |
| Gln Ser Gln Leu Asn Ala Leu Gln Ala Glu Leu Glu Thr Ile Asn     |      |
| 1025 1030 1035  |      |
| gcc caa cag caa gtg gca caa gcg gtg caa aat cag aaa gta act     | 3462 |
| Ala Gln Gln Gln Val Ala Gln Ala Val Gln Asn Gln Lys Val Thr     |      |
| 1040 1045 1050  |      |
| gca ctt aac caa aag aac gag caa gtt aaa acc act caa gat aaa     | 3507 |
| Ala Leu Asn Gln Lys Asn Glu Gln Val Lys Thr Thr Gln Asp Lys     |      |
| 1055 1060 1065  |      |
| gca aat tta gtc ttg gca act gca ttg gtg gaa aaa gaa acc gct     | 3552 |
| Ala Asn Leu Val Leu Ala Thr Ala Leu Val Glu Lys Glu Thr Ala     |      |
| 1070 1075 1080  |      |
| cag att gat ttt gct aat gca aaa tta gct cag ttg aat tta aca     | 3597 |
| Gln Ile Asp Phe Ala Asn Ala Lys Leu Ala Gln Leu Asn Leu Thr     |      |
| 1085 1090 1095  |      |

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|---|------|
| caa caa cta gaa aaa gcc tta gca gtg gct gag caa gca gaa aaa | 3642 |
| Gln Gln Leu Glu Lys Ala Leu Ala Val Ala Glu Gln Ala Glu Lys |      |
| 1100 1105 1110  |      |
| gag cgt aaa gct caa gag caa gcg aaa aga caa cgc aaa caa aaa | 3687 |
| Glu Arg Lys Ala Gln Glu Gln Ala Lys Arg Gln Arg Lys Gln Lys |      |
| 1115 1120 1125  |      |
| gac ttg atc agc cgt tat tca aat agt gcg tta tca gaa tta tct | 3732 |
| Asp Leu Ile Ser Arg Tyr Ser Asn Ser Ala Leu Ser Glu Leu Ser |      |
| 1130 1135 1140  |      |
| gca aca gta aat agt atg ctt tcc gtt caa gat gaa tta gat cgt | 3777 |
| Ala Thr Val Asn Ser Met Leu Ser Val Gln Asp Glu Leu Asp Arg |      |
| 1145 1150 1155  |      |
| ctt ttt gta gat caa gct caa tct gcg gtg tgg aca aat atc tca | 3822 |
| Leu Phe Val Asp Gln Ala Gln Ser Ala Val Trp Thr Asn Ile Ser |      |
| 1160 1165 1170  |      |
| cag gat aaa aga cgt tat gat tct gat gcg ttc cgt gct tat cag | 3867 |
| Gln Asp Lys Arg Arg Tyr Asp Ser Asp Ala Phe Arg Ala Tyr Gln |      |
| 1175 1180 1185  |      |
| cag aaa acg aac ttg cgt caa att ggg gtg caa aaa gcc tta gct | 3912 |
| Gln Lys Thr Asn Leu Arg Gln Ile Gly Val Gln Lys Ala Leu Ala |      |
| 1190 1195 1200  |      |
| aac gga cga att ggg gca gtt ttc tcg cat agc cgt tca gat aat | 3957 |
| Asn Gly Arg Ile Gly Ala Val Phe Ser His Ser Arg Ser Asp Asn |      |
| 1205 1210 1215  |      |
| act ttt gat gaa cag gtt aaa aat cac gca aca tta acg atg atg | 4002 |
| Thr Phe Asp Glu Gln Val Lys Asn His Ala Thr Leu Thr Met Met |      |
| 1220 1225 1230  |      |
| tcg ggt ttt gcc caa tat caa tgg ggt gat tta caa ttt ggt gta | 4047 |
| Ser Gly Phe Ala Gln Tyr Gln Trp Gly Asp Leu Gln Phe Gly Val |      |
| 1235 1240 1245  |      |
| aac gtg gga acg gga att agt gcg agt aaa atg gct gaa gaa caa | 4092 |
| Asn Val Gly Thr Gly Ile Ser Ala Ser Lys Met Ala Glu Glu Gln |      |
| 1250 1255 1260  |      |
| agc cga aaa att cat cga aaa gcg ata aat tat ggc gtg aat gca | 4137 |
| Ser Arg Lys Ile His Arg Lys Ala Ile Asn Tyr Gly Val Asn Ala |      |
| 1265 1270 1275  |      |
| agt tat tcg ttc cat tta ggg caa ttg ggt att cag cct tat ttt | 4182 |
| Ser Tyr Ser Phe His Leu Gly Gln Leu Gly Ile Gln Pro Tyr Phe |      |
| 1280 1285 1290  |      |
| gga gtt aat cgc tat ttt att gaa cgt aaa aat tat caa tct gag | 4227 |
| Gly Val Asn Arg Tyr Phe Ile Glu Arg Lys Asn Tyr Gln Ser Glu |      |
| 1295 1300 1305  |      |
| gaa gtg aaa gtg caa aca ccg agc ctt gca ttt aat cgc tat aat | 4272 |

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|---|------|
| Glu Val Lys Val Gln Thr Pro Ser Leu Ala Phe Asn Arg Tyr Asn       |      |
| 1310 1315 1320  |      |
| gct gga gta cgg gtc gat tat acg ttt acc ccg aca gag aat atc       | 4317 |
| Ala Gly Val Arg Val Asp Tyr Thr Phe Thr Pro Thr Glu Asn Ile       |      |
| 1325 1330 1335  |      |
| agc gtt aag cct tat ttc ttc gtc aat tat gtt gat gtt tca aac       | 4362 |
| Ser Val Lys Pro Tyr Phe Phe Val Asn Tyr Val Asp Val Ser Asn       |      |
| 1340 1345 1350  |      |
| gct aac gta caa acc act gta aat cgc gcg gtg ttg caa caa cca       | 4407 |
| Ala Asn Val Gln Thr Thr Val Asn Arg Ala Val Leu Gln Gln Pro       |      |
| 1355 1360 1365  |      |
| ttt gga cgt tat tgg caa aaa gaa gtg gga tta aaa gcg gaa att       | 4452 |
| Phe Gly Arg Tyr Trp Gln Lys Glu Val Gly Leu Lys Ala Glu Ile       |      |
| 1370 1375 1380  |      |
| tta cat ttc caa ctt tct gct ttt att tct aaa tct caa ggt tcg       | 4497 |
| Leu His Phe Gln Leu Ser Ala Phe Ile Ser Lys Ser Gln Gly Ser       |      |
| 1385 1390 1395  |      |
| caa ctc ggt aaa cag cga aat atg ggc gtg aaa tta gga tat cgt       | 4542 |
| Gln Leu Gly Lys Gln Arg Asn Met Gly Val Lys Leu Gly Tyr Arg       |      |
| 1400 1405 1410  |      |
| tgg taa aaatcaacat aattttattc taataatgga actttattta attaaaagta    | 4598 |
| Trp   |      |
| tctaagtagc accctatagg ggattaatta agaggattta ataatgaatt taactaaaat | 4658 |
| tttaccgcga ttgctgctg cagtcgtatt atctgcttgt gcaaaggatg cacctgaaat  | 4718 |
| gacaaaatca tctgcgcaaa tagctgaaat gcaaacactt ccaacaatca ctgataaaac | 4778 |
| agttgtatat tcttgcaata aacaaactgt gactgcagtg tatcaatttg            | 4828 |
| <210> 17  |      |
| <211> 1411  |      |
| <212> PRT   |      |
| <213> Haemophilus influenzae                                      |      |
| <400> 17  |      |
| Met Lys Lys Thr Val Phe Arg Leu Asn Phe Leu Thr Ala Cys Ile Ser   |      |
| 1 5 10 15   |      |
| Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr Phe Gly Ile   |      |
| 20 25 30  |      |
| Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe Thr   |      |
| 35 40 45  |      |

Val Gly Ala Lys Asn Ile Glu Val Tyr Asn Lys Asn Gly Asn Leu Val  
50 55 60

Gly Thr Ser Met Thr Lys Ala Pro Met Ile Asp Phe Ser Val Val Ser  
65 70 75 80

Arg Asn Gly Val Ala Ala Leu Val Gly Asp Gln Tyr Ile Val Ser Val  
85 90 95

Ala His Asn Val Gly Tyr Thr Asn Val Asp Phe Gly Ala Glu Gly Gln  
100 105 110

Asn Pro Asp Gln His Arg Phe Thr Tyr Lys Ile Val Lys Arg Asn Asn  
115 120 125

Tyr Lys Asn Asp Gln Thr His Pro Tyr Glu Lys Asp Tyr His Asn Pro  
130 135 140

Arg Leu His Lys Phe Val Thr Glu Ala Thr Pro Ile Asp Met Thr Ser  
145 150 155 160

Asp Met Asn Gly Asn Lys Tyr Thr Asp Arg Thr Lys Tyr Pro Glu Arg  
165 170 175

Val Arg Ile Gly Ser Gly Trp Gln Phe Trp Arg Asn Asp Gln Asn Asn  
180 185 190

Gly Asp Gln Val Ala Gly Ala Tyr His Tyr Leu Thr Ala Gly Asn Thr  
195 200 205

His Asn Gln Gly Gly Ala Gly Gly Gly Trp Ser Ser Leu Ser Gly Asp  
210 215 220

Val Arg Gln Ala Gly Asn Tyr Gly Pro Ile Pro Ile Ala Gly Ser Ser  
225 230 235 240

Gly Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp Ala Glu Lys Gln Lys  
245 250 255

Trp Leu Ile Asn Gly Val Leu Arg Thr Gly Asn Pro Trp Ala Gly Thr  
260 265 270



Glu Asn Thr Phe Gln Leu Val Arg Lys Ser Phe Phe Asp Glu Ile Leu  
 275 280 285

Glu Lys Asp Leu Arg Thr Ser Phe Tyr Ser Pro Ser Gly Asn Gly Ala  
 290 295 300

Tyr Thr Ile Thr Asp Lys Gly Asp Gly Ser Gly Ile Val Lys Gln Gln  
 305 310 315 320

Thr Gly Arg Pro Ser Glu Val Arg Ile Gly Leu Lys Asp Asp Lys Leu  
 325 330 335

Pro Ala Glu Gly Lys Asp Asp Val Tyr Gln Tyr Gln Gly Pro Asn Ile  
 340 345 350

Tyr Leu Pro Arg Leu Asn Asn Gly Gly Asn Leu Tyr Phe Gly Asp Gln  
 355 360 365

Lys Asn Gly Thr Val Thr Leu Ser Thr Asn Ile Asn Gln Gly Ala Gly  
 370 375 380

Gly Leu Tyr Phe Glu Gly Asn Phe Thr Val Ser Ser Glu Asn Asn Ala  
 385 390 395 400

Thr Trp Gln Gly Ala Gly Val His Val Gly Glu Asp Ser Thr Val Thr  
 405 410 415

Trp Lys Val Asn Gly Val Glu Asn Asp Arg Leu Ser Lys Ile Gly Lys  
 420 425 430

Gly Thr Leu His Val Lys Ala Lys Gly Glu Asn Lys Gly Ser Ile Ser  
 435 440 445

Val Gly Asp Gly Lys Val Ile Leu Glu Gln Gln Ala Asp Asp Gln Gly  
 450 455 460

Asn Lys Gln Ala Phe Ser Glu Ile Gly Leu Val Ser Gly Arg Gly Thr  
 465 470 475 480

Val Gln Leu Asn Asp Asp Lys Gln Phe Asn Thr Asp Lys Phe Tyr Phe  
 485 490 495

Gly Phe Arg Gly Gly Arg Leu Asp Leu Asn Gly His Ser Leu Thr Phe  
500 505 510

Lys Arg Ile Gln Asn Thr Asp Glu Gly Ala Thr Ile Val Asn His Asn  
515 520 525

Ala Thr Thr Glu Ser Thr Val Thr Ile Thr Gly Ser Asp Thr Ile Asn  
530 535 540

Asp Asn Thr Gly Asp Leu Thr Asn Lys Arg Asp Ile Ala Phe Asn Gly  
545 550 555 560

Trp Phe Gly Asp Lys Asp Asp Thr Lys Asn Thr Gly Arg Leu Asn Val  
565 570 575

Thr Tyr Asn Pro Leu Asn Lys Asp Asn His Phe Leu Leu Ser Gly Gly  
580 585 590

Thr Asn Leu Lys Gly Asn Ile Thr Gln Asp Gly Gly Thr Leu Val Phe  
595 600 605

Ser Gly Arg Pro Thr Pro His Ala Tyr Asn His Leu Asn Arg Leu Asn  
610 615 620

Glu Leu Gly Arg Pro Lys Gly Glu Val Val Ile Asp Asp Asp Trp Ile  
625 630 635 640

Asn Arg Thr Phe Lys Ala Glu Asn Phe Gln Ile Lys Gly Gly Ser Thr  
645 650 655

Val Val Ser Arg Asn Val Ser Ser Ile Glu Gly Asn Trp Thr Ile Ser  
660 665 670

Asn Asn Ala Asn Ala Thr Phe Gly Val Val Pro Asn Gln Gln Asn Thr  
675 680 685

Ile Cys Thr Arg Ser Asp Trp Thr Gly Leu Thr Thr Cys Lys Thr Val  
690 695 700

Asn Leu Thr Asp Lys Lys Val Ile Asp Ser Ile Pro Thr Thr Gln Ile  
705 710 715 720

Asn Gly Ser Ile Asn Leu Thr Asn Asn Ala Thr Val Asn Ile His Gly

725

730

735

Leu Ala Lys Leu Asn Gly Asn Val Thr Leu Ile Asn His Ser Gln Phe  
 740 745 750

Thr Leu Ser Asn Asn Ala Thr Gln Thr Gly Asn Ile Gln Leu Ser Asn  
 755 760 765

His Ala Asn Ala Thr Val Asp Asn Ala Asn Leu Asn Gly Asn Val His  
 770 775 780

Leu Thr Asp Ser Ala Gln Phe Ser Leu Lys Asn Ser His Phe Ser His  
 785 790 795 800

Gln Ile Gln Gly Asp Lys Asp Thr Thr Val Thr Leu Glu Asn Ala Thr  
 805 810 815

Trp Thr Met Pro Ser Asp Thr Thr Leu Gln Asn Leu Thr Leu Asn Asn  
 820 825 830

Ser Thr Val Thr Leu Asn Ser Ala Tyr Ser Ala Ser Ser Asn Asn Ala  
 835 840 845

Pro Arg His Arg Arg Ser Leu Glu Thr Glu Thr Thr Pro Thr Ser Glu  
 850 855 860

Glu His Arg Phe Asn Thr Leu Thr Val Asn Gly Lys Leu Ser Gly Gln  
 865 870 875 880

Gly Thr Phe Gln Phe Thr Ser Ser Leu Phe Gly Tyr Lys Ser Asp Lys  
 885 890 895

Ile Lys Leu Ser Asn Asp Ala Glu Gly Asp Tyr Thr Leu Ala Val Arg  
 900 905 910

Asp Thr Gly Lys Glu Pro Val Thr Leu Glu Gln Leu Thr Leu Ile Glu  
 915 920 925

Gly Leu Asp Asn Gln Pro Leu Pro Asp Lys Leu Lys Ile Thr Leu Lys  
 930 935 940

Asn Lys His Val Asp Ala Gly Ala Trp Arg Tyr Glu Leu Val Lys Lys  
 945 950 955 960

Asn Gly Glu Phe Arg Leu His Asn Pro Ile Lys Glu Gln Glu Leu Arg  
965 970 975

Asn Asp Leu Val Lys Ala Glu Gln Val Glu Arg Ala Leu Glu Ala Lys  
980 985 990

Gln Ala Glu Leu Thr Thr Lys Lys Gln Lys Thr Glu Ala Lys Val Arg  
995 1000 1005

Ser Lys Arg Ala Ala Phe Ser Asp Thr Pro Pro Asp Gln Ser Gln  
1010 1015 1020

Leu Asn Ala Leu Gln Ala Glu Leu Glu Thr Ile Asn Ala Gln Gln  
1025 1030 1035

Gln Val Ala Gln Ala Val Gln Asn Gln Lys Val Thr Ala Leu Asn  
1040 1045 1050

Gln Lys Asn Glu Gln Val Lys Thr Thr Gln Asp Lys Ala Asn Leu  
1055 1060 1065

Val Leu Ala Thr Ala Leu Val Glu Lys Glu Thr Ala Gln Ile Asp  
1070 1075 1080

Phe Ala Asn Ala Lys Leu Ala Gln Leu Asn Leu Thr Gln Gln Leu  
1085 1090 1095

Glu Lys Ala Leu Ala Val Ala Glu Gln Ala Glu Lys Glu Arg Lys  
1100 1105 1110

Ala Gln Glu Gln Ala Lys Arg Gln Arg Lys Gln Lys Asp Leu Ile  
1115 1120 1125

Ser Arg Tyr Ser Asn Ser Ala Leu Ser Glu Leu Ser Ala Thr Val  
1130 1135 1140

Asn Ser Met Leu Ser Val Gln Asp Glu Leu Asp Arg Leu Phe Val  
1145 1150 1155

Asp Gln Ala Gln Ser Ala Val Trp Thr Asn Ile Ser Gln Asp Lys  
1160 1165 1170

|      |     |     |     |     |     |      |     |     |     |     |      |     |     |     |
|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|-----|-----|-----|
| Arg  | Arg | Tyr | Asp | Ser | Asp | Ala  | Phe | Arg | Ala | Tyr | Gln  | Gln | Lys | Thr |
| 1175 |     |     |     |     |     | 1180 |     |     |     |     | 1185 |     |     |     |
| Asn  | Leu | Arg | Gln | Ile | Gly | Val  | Gln | Lys | Ala | Leu | Ala  | Asn | Gly | Arg |
| 1190 |     |     |     |     |     | 1195 |     |     |     |     | 1200 |     |     |     |
| Ile  | Gly | Ala | Val | Phe | Ser | His  | Ser | Arg | Ser | Asp | Asn  | Thr | Phe | Asp |
| 1205 |     |     |     |     |     | 1210 |     |     |     |     | 1215 |     |     |     |
| Glu  | Gln | Val | Lys | Asn | His | Ala  | Thr | Leu | Thr | Met | Met  | Ser | Gly | Phe |
| 1220 |     |     |     |     |     | 1225 |     |     |     |     | 1230 |     |     |     |
| Ala  | Gln | Tyr | Gln | Trp | Gly | Asp  | Leu | Gln | Phe | Gly | Val  | Asn | Val | Gly |
| 1235 |     |     |     |     |     | 1240 |     |     |     |     | 1245 |     |     |     |
| Thr  | Gly | Ile | Ser | Ala | Ser | Lys  | Met | Ala | Glu | Glu | Gln  | Ser | Arg | Lys |
| 1250 |     |     |     |     |     | 1255 |     |     |     |     | 1260 |     |     |     |
| Ile  | His | Arg | Lys | Ala | Ile | Asn  | Tyr | Gly | Val | Asn | Ala  | Ser | Tyr | Ser |
| 1265 |     |     |     |     |     | 1270 |     |     |     |     | 1275 |     |     |     |
| Phe  | His | Leu | Gly | Gln | Leu | Gly  | Ile | Gln | Pro | Tyr | Phe  | Gly | Val | Asn |
| 1280 |     |     |     |     |     | 1285 |     |     |     |     | 1290 |     |     |     |
| Arg  | Tyr | Phe | Ile | Glu | Arg | Lys  | Asn | Tyr | Gln | Ser | Glu  | Glu | Val | Lys |
| 1295 |     |     |     |     |     | 1300 |     |     |     |     | 1305 |     |     |     |
| Val  | Gln | Thr | Pro | Ser | Leu | Ala  | Phe | Asn | Arg | Tyr | Asn  | Ala | Gly | Val |
| 1310 |     |     |     |     |     | 1315 |     |     |     |     | 1320 |     |     |     |
| Arg  | Val | Asp | Tyr | Thr | Phe | Thr  | Pro | Thr | Glu | Asn | Ile  | Ser | Val | Lys |
| 1325 |     |     |     |     |     | 1330 |     |     |     |     | 1335 |     |     |     |
| Pro  | Tyr | Phe | Phe | Val | Asn | Tyr  | Val | Asp | Val | Ser | Asn  | Ala | Asn | Val |
| 1340 |     |     |     |     |     | 1345 |     |     |     |     | 1350 |     |     |     |
| Gln  | Thr | Thr | Val | Asn | Arg | Ala  | Val | Leu | Gln | Gln | Pro  | Phe | Gly | Arg |
| 1355 |     |     |     |     |     | 1360 |     |     |     |     | 1365 |     |     |     |
| Tyr  | Trp | Gln | Lys | Glu | Val | Gly  | Leu | Lys | Ala | Glu | Ile  | Leu | His | Phe |
| 1370 |     |     |     |     |     | 1375 |     |     |     |     | 1380 |     |     |     |

Gln Leu Ser Ala Phe Ile Ser Lys Ser Gln Gly Ser Gln Leu Gly  
 1385 1390 1395

Lys Gln Arg Asn Met Gly Val Lys Leu Gly Tyr Arg Trp  
 1400 1405 1410

<210> 18  
 <211> 47  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 18

Met Lys Lys Thr Val Phe Arg Leu Asn Phe Leu Thr Ala Cys Ile Ser  
 1 5 10 15

Leu Gly Ile Val Ser Gln Ala Trp Ala Gly His Thr Tyr Phe Gly Ile  
 20 25 30

Asp Tyr Gln Tyr Tyr Arg Asp Phe Ala Glu Asn Lys Gly Lys Phe  
 35 40 45

<210> 19  
 <211> 7  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 19

Asn Pro Asp Gln His Arg Phe  
 1 5

<210> 20  
 <211> 11  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 20

Gly Asp Ser Gly Ser Pro Met Phe Ile Tyr Asp  
 1 5 10

<210> 21  
 <211> 14  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 21

Ile Asn Gln Gly Ala Gly Gly Leu Tyr Phe Glu Gly Asn Gly

1 5 10

<210> 22  
<211> 7  
<212> PRT  
<213> Haemophilus influenzae

<400> 22

Asp Arg Leu Ser Lys Ile Gly  
1 5

<210> 23  
<211> 18  
<212> PRT  
<213> Haemophilus influenzae

<400> 23

Tyr Phe Gly Phe Arg Gly Gly Arg Leu Asp Leu Asn Gly His Ser Leu  
1 5 10 15

Thr Phe

<210> 24  
<211> 15  
<212> PRT  
<213> Haemophilus influenzae

<400> 24

Arg Ile Gln Asn Thr Asp Glu Gly Ala Met Ile Val Asn His Asn  
1 5 10 15

<210> 25  
<211> 9  
<212> PRT  
<213> Haemophilus influenzae

<400> 25

Leu Leu Leu Ser Gly Gly Thr Asn Leu  
1 5

<210> 26  
<211> 13  
<212> PRT  
<213> Haemophilus influenzae

<400> 26

Phe Ser Gly Arg Pro Thr Pro His Ala Tyr Asn His Leu  
 1 5 10

<210> 27  
 <211> 36  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 27

Arg Thr Phe Lys Ala Glu Asn Phe Gln Ile Lys Gly Gly Ser Ala Val  
 1 5 10 15

Val Ser Arg Asn Val Ser Ser Ile Glu Gly Asn Trp Thr Val Ser Asn  
 20 25 30

Asn Ala Asn Ala  
 35

<210> 28  
 <211> 23  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 28

Phe Gly Val Val Pro Asn Gln Gln Asn Thr Ile Cys Thr Arg Ser Asp  
 1 5 10 15

Trp Thr Gly Leu Thr Thr Cys  
 20

<210> 29  
 <211> 7  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 29

Lys Val Ile Asn Ser Ile Pro  
 1 5

<210> 30  
 <211> 14  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 30



Thr Gln Ile Asn Gly Ser Ile Asn Leu Thr Asp Asn Ala Thr  
1 5 10

<210> 31  
<211> 11  
<212> PRT  
<213> Haemophilus influenzae

<400> 31

Gly Leu Ala Lys Leu Asn Gly Asn Val Thr Leu  
1 5 10

<210> 32  
<211> 12  
<212> PRT  
<213> Haemophilus influenzae

<400> 32

His Ser Gln Phe Thr Leu Ser Asn Asn Ala Thr Gln  
1 5 10

<210> 33  
<211> 12  
<212> PRT  
<213> Haemophilus influenzae

<400> 33

Ala Thr Val Asp Asn Ala Asn Leu Asn Gly Asn Val  
1 5 10

<210> 34  
<211> 18  
<212> PRT  
<213> Haemophilus influenzae

<400> 34

Asp Ser Ala Gln Phe Ser Leu Lys Asn Ser His Phe Ser His Gln Ile  
1 5 10 15

Gln Gly

<210> 35  
<211> 11  
<212> PRT  
<213> Haemophilus influenzae

<400> 35

Leu Glu Asn Ala Thr Trp Thr Met Pro Ser Asp  
1 5 10

<210> 36

<211> 11

<212> PRT

<213> Haemophilus influenzae

<400> 36

Thr Leu Gln Asn Leu Thr Leu Asn Asn Ser Thr  
1 5 10

<210> 37

<211> 8

<212> PRT

<213> Haemophilus influenzae

<400> 37

Thr Leu Asn Ser Ala Tyr Ser Ala  
1 5

<210> 38

<211> 54

<212> PRT

<213> Haemophilus influenzae

<400> 38

Arg Arg Ser Leu Glu Thr Glu Thr Thr Pro Thr Ser Ala Glu His Arg  
1 5 10 15

Phe Asn Thr Leu Thr Val Asn Gly Lys Leu Ser Gly Gln Gly Thr Phe  
20 25 30

Gln Phe Thr Ser Ser Leu Phe Gly Tyr Lys Ser Asp Lys Leu Ser Asn  
35 40 45

Asp Ala Glu Gly Asp Tyr  
50

<210> 39

<211> 10

<212> PRT

<213> Haemophilus influenzae

<400> 39

Leu Ser Val Arg Asn Thr Gly Lys Glu Pro  
1 5 10

<210> 40  
<211> 10  
<212> PRT  
<213> Haemophilus influenzae

<400> 40

Gln Leu Thr Leu Val Glu Ser Lys Asp Asn  
1 5 10

<210> 41  
<211> 20  
<212> PRT  
<213> Haemophilus influenzae

<400> 41

Phe Thr Leu Glu Asn Asp His Val Asp Ala Gly Ala Leu Arg Tyr Lys  
1 5 10 15

Leu Val Lys Asn  
20

<210> 42  
<211> 14  
<212> PRT  
<213> Haemophilus influenzae

<400> 42

Gly Glu Phe Arg Leu His Asn Pro Ile Lys Glu Gln Glu Leu  
1 5 10

<210> 43  
<211> 18  
<212> PRT  
<213> Haemophilus influenzae

<400> 43

Asp Leu Val Arg Ala Glu Gln Ala Glu Arg Thr Leu Glu Ala Lys Gln  
1 5 10 15

Val Glu

<210> 44  
 <211> 73  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 44

Leu Ile Ser Arg Tyr Ser Asn Ser Ala Leu Ser Glu Leu Ser Ala Thr  
 1 5 10 15

Val Asn Ser Met Leu Ser Val Gln Asp Glu Leu Asp Arg Leu Phe Val  
 20 25 30

Asp Gln Ala Gln Ser Ala Val Trp Thr Asn Ile Ala Gln Asp Lys Arg  
 35 40 45

Arg Tyr Asp Ser Asp Ala Phe Arg Ala Tyr Gln Gln Lys Thr Asn Leu  
 50 55 60

Arg Gln Ile Gly Val Gln Lys Ala Leu  
 65 70

<210> 45  
 <211> 27  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 45

Asn Gly Arg Ile Gly Ala Val Phe Ser His Ser Arg Ser Asp Asn Thr  
 1 5 10 15

Phe Asp Glu Gln Val Lys Asn His Ala Thr Leu  
 20 25

<210> 46  
 <211> 20  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 46

Met Met Ser Gly Phe Ala Gln Tyr Gln Trp Gly Asp Leu Gln Phe Gly  
 1 5 10 15

Val Asn Val Gly  
 20

<210> 47  
 <211> 40  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 47

Gly Ile Ser Ala Ser Lys Met Ala Glu Glu Gln Ser Arg Lys Ile His  
 1 5 10 15

Arg Lys Ala Ile Asn Tyr Gly Val Asn Ala Ser Tyr Gln Phe Arg Lys  
 20 25 30

Gly Gln Leu Gly Ile Gln Pro Tyr  
 35 40

<210> 48  
 <211> 17  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 48

Gly Val Asn Arg Tyr Phe Ile Glu Arg Glu Asn Tyr Gln Ser Glu Glu  
 1 5 10 15

Val

<210> 49  
 <211> 20  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 49

Phe Asn Arg Asn Ala Gly Ile Arg Val Asp Tyr Thr Phe Thr Pro Thr  
 1 5 10 15

Asp Asn Ile Ser  
 20

<210> 50  
 <211> 21  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 50

Lys Pro Tyr Phe Phe Val Asn Tyr Val Asp Val Ser Asn Ala Asn Val

1 5 10 15

Gln Thr Thr Val Asn  
20

<210> 51  
<211> 19  
<212> PRT  
<213> Haemophilus influenzae

<400> 51

Phe Gly Arg Tyr Trp Gln Lys Glu Val Gly Leu Lys Ala Glu Ile Leu  
1 5 10 15

His Phe Gln

<210> 52  
<211> 26  
<212> PRT  
<213> Haemophilus influenzae

<400> 52

Ser Ala Phe Ile Ser Lys Ser Gln Gly Ser Gln Leu Gly Lys Gln Gln  
1 5 10 15

Asn Val Gly Val Lys Leu Gly Tyr Arg Trp  
20 25

<210> 53  
<211> 8  
<212> PRT  
<213> Haemophilus influenzae

<400> 53

Gly Asp Ser Gly Ser Pro Met Phe  
1 5

<210> 54  
<211> 8  
<212> PRT  
<213> Neisseria gonorrhoeae

<400> 54

Gly Asp Ser Gly Ser Pro Leu Phe  
1 5

<210> 55  
 <211> 7  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 55

His Thr Tyr Phe Gly Ile Asp  
 1 5

<210> 56  
 <211> 28  
 <212> DNA  
 <213> Haemophilus influenzae

<400> 56  
 tgcaggatcc ccgcagactg gattgttg

28

<210> 57  
 <211> 28  
 <212> DNA  
 <213> Haemophilus influenzae

<400> 57  
 tgcaggatcc gatctgcccc accttggt

28

<210> 58  
 <211> 7  
 <212> PRT  
 <213> Haemophilus influenzae

<400> 58

Gly Asp Ser Gly Ser Pro Met  
 1 5